DOCUMENT RESUME

ED 329 101 FL 018 829

TITLE	English Skills for Physical Science. Unit 1--Problem Solving in Physical Science. Tutor Version and Student Version.
INSTITUTION	Arlington County Public Schools, Va.; California Univ., Los Angeles. Center for Language Education and Research.; Center for Applied Linguistics, Washington, D.C.
SPONS AGENCY	Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE	90
NOTE	166p.; For related documents, see FL 018 831 and FL 018 833.
PUB TYPE	Guides - Classroom Use - Instructional Materials (For Learner) (051) -- Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC07 Plus Postage.
DESCRIPTORS	Concept Formation; Cooperative Learning; English (Second Language); *English for Science and Technology; Introductory Courses; *Limited English Speaking; *Mathematical Formulas; *Problem Solving; *Science Instruction; Secondary Education; Second Language Instruction; Vocabulary Development; *Word Problems (Mathematics); Workbooks
IDENTIFIERS	*Simplification (Language)

ABSTRACT

This manual is part of a series of materials designed to reinforce essential concepts in physical science through interactive, language-sensitive, problem-solving exercises emphasizing cooperative learning. The manual is intended for limited-English-proficient (LEP) students in beginning physical science classes. The materials are for teams of two students, the student and the tutor, with a separate workbook for each. Questions appear in the student workbook, prompts and answers in the otherwise identical tutor workbook. This combined document consists of the "Tutor Version" followed by the "Student Version." Unit 1 focuses on solving word problems using five common formulas in physical science. There is a section for each formula, beginning with questions about the formula itself and moving to word problems requiring the target formula. The workbook de-emphasizes numerical answers and guides the student, step by step, through the process of solving a problem. For each problem, students must answer questions measuring comprehension of content, ability to translate words into symbols, and ability to correctly insert numbers in the equation. (MSE)

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ENGLISH SKILLS FOR PHYSICAL SCIENCE

UNIT 1 - Problem Solving in Physical Science

Center for Language Education and Research

Center for Applied Linguistics

Arlington County Public Schools

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ENGLISH SKILLS FOR PHYSICAL SCIENCE

UNIT 1 - Problem Solving in Physical Science

TUTOR VERSION

Center for Language Education and Research

Center for Applied Linguistics

Arlington County Public Schools

TEACHER'S GUIDELINES

These materials are designed to reinforce essential concepts in physical science through the use of interactive, language-sensitive problem solving exercises. The targeted students are limited English proficient (LEP) students in beginning physical science classes.

It is intuitively obvious that students have difficulty learning content information unless that content is cognitively accessible to them; that is, unless it is presented to them in a comprehensible way. Good teachers have always done this; they assess students' knowledge and start their explanations from the students' understanding. But for LEP students, making the content cognitively accessible includes not only building content explanations from their base knowledge but also presenting the content in comprehensible language forms. It is only when accessible content is presented through accessible language that either is successfully mastered.

Language-sensitive instruction does not "dumb down" the curriculum; it merely makes the existing content material cognitively accessible to the student. This is accomplished through modifications such as deciding which specialized vocabulary items are truly necessary at the beginning levels and presenting them at a manageable rate; recognizing that some everyday words (serrated, slimy) are unfamiliar to LEP students and must also be treated as new vocabulary; making certain that the language used makes explicit connections between related facts and their unifying concepts; and avoiding the highly complex sentence structures so often found in scientific and technical writing. And if the material is cognitively accessible, students are not limited to rote

memorization of poorly grasped facts but can bring higher cognitive processes to bear on their attempts to assimilate the information.

The ability to solve problems—that is, the ability to apply learned information to new and different situations—has long been recognized as a goal of education. There is, however, a growing body of research which suggests that problem-solving is the very process through which effective learning is accomplished. Problem-solving is perhaps particularly important in the sciences, where "facts" change so rapidly due to leaps in technology that memorization is becoming all but obsolete as a scientific tool.

Thus, problem solving is moving from product to process. One of the goals of the educational system, then, should surely be to help students develop the necessary problem-solving skills. Many different paradigms have been developed to demonstrate problem-solving techniques, but most rely at least upon identifying the problem, isolating the relevant facts, and setting these facts in the proper relationship to each other in order to determine a solution.

Cooperative learning and problem-solving are natural partners; the problem-solving tasks of identifying, isolating, and relating facts readily lend themselves to this kind of mutual effort, with each member contributing his own understanding to the problem at hand. The point of cooperative learning is that students are able to help each other learn; they can share ideas, model appropriate strategies, and otherwise move each other toward mastery of the specified material. Students are compelled to clarify their thoughts about the subject matter because they must convey their ideas to each other and must reconcile conflicting impressions as they work toward a solution.

Cooperative learning is an equally effective partner to language learning. Language is learned most effectively when it is used for real communication, as the vehicle for thoughts rather than as an end in itself. Cooperative learning requires students to carry out involved verbal tasks such as explaining, clarifying, and negotiating, where the content of the message is the central concern.

Thus the educational strategies underlying these materials serve to complement each other in ways that elicit the abilities of students who might otherwise be unable to express themselves. Language-sensitive instruction provides the students with appropriate comprehensible information; problem-solving tasks guide them toward successful assimilation of that knowledge; and cooperative learning compels them to articulate their understanding of the material as they work together toward mastery of the content.

ORGANIZATION OF MATERIALS

The materials are designed to be used by teams of two students, the Student and the Tutor. A separate workbook is provided for each member of the team. The question for each task appears in the Student workbook, with accompanying prompts and answers in the Partner workbook.

ORGANIZING THE STUDENT/TUTOR TEAMS

If the class consists of both native and non-native speakers of English, use native/non-native teams. This will provide the best language model for the non-native students. If the class consists only of non-native speakers, try to team students of different language backgrounds to encourage their use of English rather than their native language.

CONTENT

Unit 1 focuses on solving word problems using 5 common formulas in physical science. There are five sections, each dealing with a different formula.

Each section begins with questions about the formula itself. It is important to reinforce the meaning of the symbols in the formula and their relationship. These questions discuss the formula in qualitative terms.

The remainder of each section is devoted to word problems which require the target formula. The workbook takes a step approach to problem-solving. Rather than emphasizing the numerical answer, these questions guide the student, step by step, through the *process* of solving a problem. For each word problem, the student must answer questions that measure comprehension of the content of the question, ability to translate words to symbols, and finally, the ability to correctly put the numbers into the equation.

Unit 2 focuses on physical science terminology, symbolism, and graphic representations. A glossary of physical science terms and notations is given. The glossary is followed by exercises which test comprehension of vocabulary. Students are encouraged to consult the glossary for help. This not only reinforces the terms, but provides practice in manipulating the language.

Interpreting and drawing graphs is often a difficult task for students. Therefore, a section describing the uses of various graph types has been included. Students are asked to interpret graphs. Eventually they are given data and required to choose the appropriate type of graph and to draw the graph.

The final section covers chemistry, including safety in the laboratory, equipment, experimental design, symbolic notation, and basic molecular concepts. Since the number of elements and compounds is so great, there will doubtless be some substances emphasized here that are not covered by all teachers. It may be necessary to instruct students to skip compounds that have not been covered in class.

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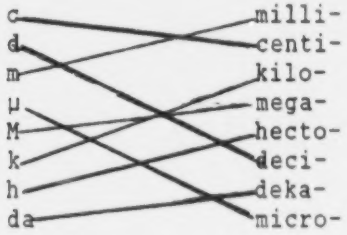
I. MEASUREMENT

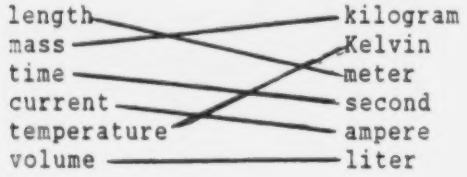
Matching

TUTOR: Check your partner's answers. The correct answers are below.

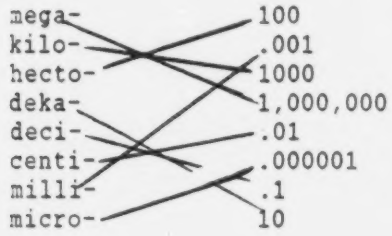
1. Match each symbol on the left to the prefix that it stands for.



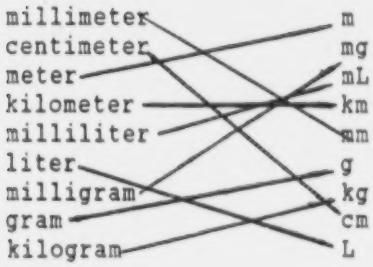
2. Match each type of measurement on the left with its base unit.



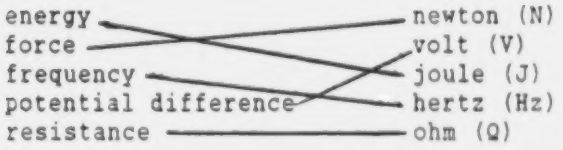
3. Match each prefix on the left with its multiplier.



4. Match each unit on the left with its symbol.



5. Match each type of measurement on the left with its unit.



MEASUREMENT

Conversion from one unit to another

To convert from one unit to another in the metric system, you need to know base units and what the prefixes mean. The base units are standard units. Other units are described in terms of base units. Most base units have no prefix. (The exception to this rule is "kilogram." You might expect "gram" to be the base unit for mass because it has no prefix.) The prefixes tell you how a unit compares with a base unit. For example, a milliliter is one thousandth as big as a liter. The milli- part means "one thousandth." So to make a liter, you would need one thousand milliliters.

Here are some examples of conversion in the metric system.

A. 111 meters is how many kilometers?
"Kilo-" means "a thousand"; one kilometer is a thousand times bigger than a meter. Another way to say this is one meter is one thousandth as big as a kilometer. So to get the answer, multiply 111 meters by one thousandth (.001). You get .111 Km.

B. 38 centimeters is how many decimeters?
"Centi-" means "a hundredth" and "deci-" means "a tenth." So a centimeter is a hundredth as big as a meter and a decimeter is a tenth as big as a meter. That means a decimeter is ten times bigger than a centimeter. Or you could say that a centimeter is one tenth the size of a decimeter. So to get the answer, multiply 38 centimeters by one tenth (.1). You get 3.8 decimeters.

C. .092 liters is how many milliliters?
"Milli-" means "one thousandth." That means a milliliter is equal to one thousandth of a liter. So if it takes a thousand milliliters to make a liter, multiply .092 by a thousand to get the answer. The answer is 92 mL.

MEASUREMENT

Restate the following measurements in the given units.

TUTOR: Check your partner's answers. The correct answers are given below.

6. 4 centimeters = .04 meters.
7. .18 meters = 180 millimeters.
8. 3010 millimeters = 301 centimeters.
9. 7.5 meters = 750 centimeters.
10. 222 centimeters = 22.2 millimeters.
11. 46 millimeters = .046 meters.
12. 71.3 centimeters = .713 meters.
13. 4900 millimeters = 4.9 meters.
14. 5 liters = 5000 milliliters.
15. 60.7 milliliters = .0607 liters.
16. 840 milliliters = .84 liters.
17. .039 liters = 39 milliliters.
18. 95 grams = .095 kilograms.
19. .058 kilograms = 58,000 milligrams.
20. 67 milligrams = .067 grams.
21. 8.1 kilograms = 8100 grams.
22. 32 grams = 32,000 milligrams.
23. 7400 milligrams = .0074 kilograms.
24. 290 grams = .29 kilograms.
25. 654,321 milligrams = .654321 kilograms.

MEASUREMENT

Converting from Celsius to Kelvin.

Converting from Celsius (or Centigrade) to Kelvin is very easy. Temperatures on the Kelvin scale are 273 degrees hotter than temperatures on the Celsius scale. So 27 degrees Celsius is 300 Kelvin.

TUTOR: Check your partner's answers with the answers given below.

27. If the temperature of a solution is 65° C, what is its temperature on the Kelvin scale?

A. 208 K
(B.) 338 K
C. 65 K

28. If the temperature outside is 296 K, what is the temperature on the Celsius scale?

(A.) 23° C
B. 569° C
C. 55° C

II. $S = d/t$

A. FORMULA PROBLEMS

Read each question and circle the correct answer.

TUTOR: Check to see that your partner has the correct answers.

1. What does the d stand for in this formula?
   (A.) distance
   B. density
   C. deceleration

2. What does the t stand for in this formula?
   A. temperature
   (B.) time
   C. theory

3. What does the S stand for in this formula?
   A. specific heat
   (B.) speed
   C. standard

4. What is the base unit of measurement for distance?
   A. kilometer
   (B.) meter
   C. centimeter

5. What is the base unit of measurement for time?
   (A.) second
   B. hour
   C. minute

6. What is the base unit of measurement for speed?
   A. kilometer/second (km/sec)
   (B.) meter/second (m/sec)
   C. meter/second^2 (m/sec^2)

7. In this formula, speed is shown in terms of what two measurements?
   A. density and time
   B. velocity and distance
   (C.) distance and time

$S = d/t$

8. How would you re-arrange this formula to show time in terms of speed and distance?
   (A.) $t = d/S$
   B. $t = d \times S$
   C. $t = d + S$

9. How would you re-arrange this formula to show distance in terms of speed and time?
   A. $d = t + S$
   B. $d = S/t$
   (C.) $d = t \times S$

10. Which of the following statements is true? Explain your answer.
   (A.) If the distance increases, then the speed will also increase.
   B. If the distance increases, then the time will also increase.
   C. If the speed increases but the distance stays the same, then the time will increase.

11. What would make the value of S get bigger? Explain your answer.
   A. t would have to get bigger as d stayed the same.
   B. d would have to get smaller as t stayed the same.
   (C.) d would have to get bigger as t stayed the same.

12. What will happen to the speed if the time gets bigger and bigger? Explain your answer.
   A. The speed will stay the same.
   (B.) The speed will decrease.
   C. The speed will increase.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

1. An airplane flew 2000 kilometers in 5 hours. How fast was the airplane flying?

How many kilometers did the airplane fly?

A. 5 km
(B.) 2000 km
C. 2005 km

How long did it take the airplane to fly 2000 kilometers?

(A.) 5 hours
B. 2000 hours
C. 400 hours

2. How long will it take a car to go from Washington, DC to Los Angeles if the two cities are 3000 miles apart and the car's average speed is 40 miles per hour?

40 miles per hour is the car's

A. maximum speed
B. constant speed
(C.) average speed

How far is it from Washington to Los Angeles?

A. 40 miles
(B.) 3000 miles
C. 1500 miles

How far must the car travel?

A. 40 miles
(B.) 3000 miles
C. 1500 miles

3. A dog is walking down the street at a speed of 3.5 miles per hour. If the dog walks at this pace for 1.5 hours, how far will it walk?

What are you looking for in this problem?

A. the time it will take the dog to walk 3.5 miles
(B.) the distance the dog will walk in 1.5 hours
C. the dog's average speed

To solve this problem, you need to know the dog's speed and

(A.) how many hours the dog will walk
B. where the dog started
C. where the dog is going

The correct answer is A. This problem gives you the dog's speed - 3.5 miles per hour - and asks you to find the distance it will walk. The problem doesn't tell you where the dog started or where it is going, but these things won't help you figure out how far the dog will walk. To solve the problem, you must know the dog's speed and how long the dog will walk.

If your partner has trouble with this problem, remind him/her that word problems tell you everything you need to know. You will never need something the problem doesn't give you.

4. A subway train travels at a speed of 45 miles per hour. How long will it take the subway train to travel 12 miles?

What does this problem ask you to find?

A. the rate of acceleration of the subway train
B. the subway train's destination
(C.) the time it takes the subway train to travel 12 miles

To reach the solution, you need to know

A. distance and acceleration
(B.) speed and distance
C. mass and distance

The answer is B. This problem gives you two values, distance and speed, and asks you to find a value for time. This problem doesn't mention acceleration or mass.

5. A boat sails from one island to another. The two islands are 11 miles apart and it takes the boat 1.2 hours to get from one to the other.

Which question best completes this word problem?

(A.) What is the boat's average speed?
B. What is the boat's maximum speed?
C. How long was the boat sailing?

The correct answer is A. This problem gives you values for distance and time. There is only one formula that uses distance and time: S = d/t. The missing value is speed. This speed is an average speed, not a maximum speed. Just by knowing distance and time, there is no way to find maximum speed.

If your partner is having difficulty, remind him/her that all good word problems work the same way. They all tell you what you need to know. It might also be helpful to remind your partner that the formulas in this workbook all have three variables. So once you know what the problem tells you, you can figure out what it will ask. These hints are useful whenever you are solving word problems.

6. A camel walks through the desert at a speed of 5 miles an hour. How long will it take the camel to walk 17 miles?

How fast does the camel walk?

A. 17 miles per hour
(B.) 5 miles per hour
C. 10 miles per hour

How far will the camel walk?

(A.) 17 miles
B. 5 miles
C. 10 miles

7. The distance between Little Rock and Omaha is 944 kilometers. How fast would a car have to travel to get from Omaha to Little Rock in 12 hours?

944 kilometers is

A. the distance from Omaha
(B.) the distance from Omaha to Little Rock
C. the distance from Little Rock to Omaha and back

How long will it take the car to drive from Omaha to Little Rock?

A. 944 hours
B. 24 hours
(C.) 12 hours

8. A greyhound runs 2.4 kilometers in 2.33 minutes. What is the dog's average speed?

This problem asks you to find how fast the greyhound runs. From the information given in the problem, you already know the greyhound runs _____.

A. all day long
(B.) 2.4 kilometers
C. 2.33 kilometers

You also know from the problem that the greyhound runs 2.4 kilometers _____.

A. every 5 minutes
(B.) in 2.33 minutes
C. in 2.33 hours

Fill in the blanks.

TUTOR: Check your partner's answers. The correct answers are given below.

9. A horse is running 25 miles an hour. How far will it run in 15 minutes?

10. Every 6 hours a weed grows another centimeter. How long will it take for the weed to grow 8 centimeters?

Rearrange these parts to make a complete word problem.

TUTOR: Check your partner's answers with the correct answers given below.

11. A snake slithers at a rate of
will it take the snake to slither
How long
3 miles/hour.
4.5 miles?

ANSWER: A snake slithers at a rate of 3 miles/hour. How long will it take the snake to slither 4.5 miles?

12. It takes a person 3.5 hours
to walk along a trail
At what speed is
that is 7.2 miles long.
the person walking?

ANSWER: It takes a person 3.5 hours to walk along a trail that is 7.2 miles long. At what speed is the person walking?

Read the information given and tell what you think the problem should ask.

TUTOR: Listen as your partner reads the problem and fills in the missing question. The answers are printed below. Your partner's answers don't have to match the printed answers exactly. When your partner's answer is different from the printed answer, make sure they mean the same thing.

13. A train travels at an average speed of 110 miles per hour. The train is going from Washington to Baltimore. The two cities are 55 miles apart.

<u>How long will it take the train to travel from Washington to Baltimore?</u>

14. A jogger runs 5 miles every morning. It takes the jogger 57 minutes to complete this workout.

<u>What is the jogger's average speed</u>?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there may be explanations for you to read to your partner.

15. A balloon floats .411 kilometers in .24 hours. What is the balloon's speed?

What does this problem ask you to find?
(A.) the balloon's speed
B. the acceleration of the balloon
C. the balloon's mass

Which formula will you need?
(A.) S=d/t
B. S=t/d
C. W=F x d

16. A car is travelling the 606.4 kilometers from Los Angeles to San Francisco. If the car's average speed is 66 kilometers per hour, how long will the trip take?

What does this problem ask you to find?
A. the car's maximum speed
(B.) the time the trip will take
C. the car's average speed

Write the formula you will need.
t = d/S

17. A steamboat traveled down a river that was 21.8 kilometers long in 1.4 hours. What was the steamboat's average speed?

To find the steamboat's average speed, you will have to _____ the distance by 1.4 hours.
A. multiply
B. increase
(C.) divide

The correct answer is C. The formula that involves distance, time, and speed is S = d/t or speed = distance/time. To find speed, you divide the distance by time.

18. A raft is floating down a river that flows at a rate of 16 miles an hour. How long will it take the raft to travel 3.2 miles?

What are you looking for in this problem?

A. the speed of the river
(B.) the time it will take the raft to travel 3.2 miles
C. the distance the raft will travel in 1 hour.

What information does this problem give you?

(A.) the speed of the river is 16 miles/hour
B. the speed of the river is 3.2 miles/hour
C. the raft will travel 16 miles

In this problem, the time it will take the raft to travel 3.2 miles is equal to

A. the speed of the river multiplied by 3.2 miles
B. the distance the raft will travel in one hour multiplied by the speed of the raft
(C.) 3.2 miles divided by the speed of the river

The correct answer is C. This problem gives you speed and distance and asks for time. The formula that uses these three things is $S = d/t$. Because you are looking for time (t), it might be helpful to rewrite the formula as $t = d/S$. Time is equal to distance divided by speed.

If your partner is having difficulty, remind him/her that once you have the right formula in the right form (what you're looking for is on the left), variables stand for numbers. In #18 d equals distance and distance equals 3.2 miles. S equals speed and speed equals 16 miles an hour. So d and S are <u>general</u> ways of talking about things. 3.2 miles and 16 miles an hour are <u>specific</u> values that relate to a <u>specific</u> word problem. This is good to know whenever you are solving word problems.

19. How long will it take a car to go from Duluth to Minneapolis if the car's average speed is 38 miles an hour and the cities are 175 miles apart?

What are you looking for in this problem?

A. the car's maximum speed
(B.) the time it will take the car to travel 175 miles
C. the distance the car will travel in one hour

What does this problem tell you?

(A.) the distance the car will travel
B. how long the car will travel
C. the car's maximum speed

In this problem, the time it will take the car to travel 175 miles is equal to

A. 175 miles divided by the speed
B. 38 miles an hour divided by the distance
C. the speed times 175 miles

The correct answer is A. This problem gives you speed and distance and asks for time. The formula you should use is $S = d/t$. Because you are looking for time (t), it might be helpful to rewrite this formula as $t = d/S$. Time equals distance divided by speed.

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

TUTOR: Listen as your partner reads the problem and decides whether enough information, too much information, or just the right amount of information is given. Explanations are given so you can help your partner.

20. A bird is flying at a speed of 47 kilometers per hour. If it flies for 3.6 hours, how far will it fly?

JUST RIGHT

21. A marathon runner is running from Washington, D.C. to Baltimore. It takes him 5 hours to reach Baltimore. How far is it from Washington, D.C. to Baltimore?

NOT ENOUGH

The problem needs to tell you the speed of the runner.

22. A skier weighing 70 kilograms is skiing at a speed of 60 miles an hour. How long will it take the skier to ski 2 miles?

TOO MUCH

The skier's weight is unnecessary. All you need is two numbers that fit into the same formula. In this problem, the numbers are 60 miles/hour (speed) and 2 miles (distance). These numbers fit into the formula S=d/5. There's no room here for other things like weight.

23. A space ship is flying at a speed of 1 million miles a day. The Martians plan to reach their destination in 30 days. How far will the space ship fly in that time?

JUST RIGHT

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled.

24. A snake slithers around for .6 hours. In that time, the snake slithers 6.7 kilometers. How fast is the snake slithering?

What does this problem ask you to find?
- A. how far the snake slithered
- (B.) the snake's speed
- C. the snake's mass

Which equation will you need?
- (A.) S = d/t
- B. S = d x t
- C. S = t/d

After filling in all the numbers you can, what does the equation look like?

S = 6.7 km/.6 hr

25. If two people row a boat for 1.3 hours and have an average speed of 7.1 kilometers per hour, how far will they travel?

What does this problem ask you to find?
- (A.) the distance the boat will travel
- B. the average speed of the boat
- C. the boat's mass

Which formula will you need?
- A. d = m x a
- B. d = t/S
- (C.) d = S x t

After filling in all the numbers you can, what does the equation look like?

d = 7.1 km per hr x 1.3 hr

26. A rocket ship moves 7000 kilometers through space in 2 seconds. How fast is the rocket moving?

How far did the rocket fly?
- A. 7000 meters
- (B.) 7000 kilometers
- C. 2 seconds

How long did it take the rocket to travel 7000 kilometers?
- A. 7 meters
- B. 7 seconds
- (C.) 2 seconds

What does this problem ask you to find?
- (A.) The speed of the rocket
- B. How far the rocket flew
- C. How long the rocket flew

To solve this problem, you need to know how far the rocket moved and _____.
- A. the distance the rocket flew
- B. the size of the rocket
- (C.) how long the rocket moved

Which formula will you need to solve this problem?
- A. t = s x d
- (B.) s = d/t
- C. W = F x d

To find the rocket's speed, you will have to _____ 7000 kilometers by 2 seconds.
- A. decrease
- (B.) divide
- C. multiply

After filling in all the numbers you can, what does the equation look like?

s=7000 km / 2 sec

III. $F = m \times a$

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

TUTOR: Check to see that your partner has the correct answer.

1. What does the m stand for in this formula?
   A. meter
   (B.) mass
   C. magnetism

2. What does the a stand for in this formula?
   (A.) acceleration
   B. ampere
   C. alpha

3. What does the F stand for in this formula?
   (A.) force
   B. formula
   C. frequency

4. What is the base unit of measurement for mass?
   A. gram (g)
   B. milliliter (mL)
   (C.) kilogram (kg)

5. What is the base unit of measurement for acceleration?
   (A.) meter/second^2 (m/sec^2)
   B. meter/second (m/sec)
   C. meter (m)

6. What is the unit of measurement for force?
   A. meter/second^2 (m/sec^2)
   (B.) kilogram x meter/sec^2 (kg x m/sec^2)
   C. kilogram x meter/sec (kg x m/sec)

7. What is another name for 1 kg x 1 m/sec^2?
   A. work
   (B.) newton
   C. rate

$F = m \times a$

8. In this formula, force is shown in terms of what two measurements?
   A. meter and acceleration
   B. acceleration and mass
   C. work and mass

9. How would you re-arrange this formula to show acceleration in terms of mass and force?
   A. $a = F/m$
   B. $a = m/F$
   C. $a = m \times F$

10. How would you re-arrange this formula to show mass in terms of force and acceleration?
   A. $m = a/F$
   B. $m = F \times a$
   C. $m = F/a$

11. Which of the following statements is true? Explain your answer.
   A. If the mass increases, then the acceleration will also increase.
   B. If the mass increases, then the force will get bigger.
   C. If the mass increases, then the force will decrease.

12. What will happen to the acceleration if the mass decreases and the force stays the same? Explain your answer.
   A. The acceleration will stay the same.
   B. The acceleration will decrease.
   C. The acceleration will increase.

13. What would make the value of F get smaller? Explain your answer.
   A. If m and a increased, F would get smaller.
   B. If m decreased and a stayed the same, F would get smaller.
   C. If a increased and m stayed the same, F would get smaller.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

1. A tennis player hits a tennis ball with a force of 80 newtons. The ball weighs 50 grams. How fast will the tennis ball accelerate?

How much does the ball weigh?

A. 80 grams
(B.) 50 grams
C. 50 kilograms

What force does the tennis player hit the ball with?

A. 50 newtons
B. 80 joules
(C.) 80 newtons

2. If a book has a mass of 1.2 kilograms and is accelerated at the rate of 2 meters per second each second, how much force acted on it?

What did the force act on?

(A.) a book
B. a meter
C. a kilogram

At what rate did the book accelerate?

A. 1.2 meters/sec^2
B. 2 meters/sec^2
(C.) 2 meters

1.2 kilograms is the book's

A. density
(B.) mass
C. force

3. A force of 360 newtons is applied in accelerating a load of bricks at a rate of 3 meters per second each second. What is the mass of the load of bricks?

What are you looking for in this problem?
A. the mass of one brick
(B.) the mass of the load of bricks
C. the number of bricks in the load

To solve this problem, you need to know the force used and
A. the mass of one brick
B. the distance traveled by the load of bricks
(C.) the acceleration of the load of bricks

The answer is C. Knowing the mass of one brick wouldn't help you solve the problem. This problem deals with "a load of bricks." That means many bricks. The problem doesn't tell you how far the bricks traveled, either. This problem does tell you the rate of acceleration of the bricks - 3 meters/second^2.

4. A child weighing 15 kilograms is sitting on a swing. If the child is pushed with a force of 32 newtons, what is the rate of acceleration?

What are you looking for in this problem?
A. the distance the child will travel
(B) the rate of acceleration
C. the amount of work done

To reach the solution, you need to know
(A.) mass and force
B. distance and force
C. distance and speed

The correct answer is A. In order to find acceleration, you need to know force and mass. This problem gives you mass and force and asks for acceleration. The problem doesn't give you values for distance or speed.

5. A force of 80 newtons is applied to an object with a mass of 25 kilograms.

Which question best completes this word problem?
A. How far will the object travel?
(B) At what rate will the object accelerate?
C. How much work is done?

The correct answer is B. This problem gives you a value for force and a value for mass. There is one formula that uses

force and mass: F = m x a. The missing value is acceleration. The formula doesn't say anything about distance or work.

If your partner is having difficulty, remind him/her that all good word problems work the same way. They all tell you what you need to know. It might also be helpful to remind your partner that the formulas in this workbook have three variables. So once you know what the problem tells you, you can figure out what it will ask. These hints are useful whenever you are solving word problems.

6. A loaf of bread with a mass of 624 grams accelerates at a rate of 1.21 meters per second each second. How much force was applied to the loaf of bread?

What is the rate of acceleration?

A. 1.1 meters
(B.) 1.21 meters
C. 1.21 meters per second squared

What is the mass of the loaf of bread?

(A.) 624 grams
B. 1.21 grams
C. 320 grams

7. A construction worker pushes a block with a force of 366 newtons. If the block has a mass of 204 kilograms, at what rate will the block accelerate?

366 newtons is

A. the weight of the block
(B.) the force applied to the block
C. the block's rate of acceleration

204 kilograms is

(A.) the block's mass
B. the block's volume
C. the force applied to the block

8. A force of 32 newtons is applied in moving a bed with a mass of 55 kilograms. At what rate does the bed accelerate?

From the information given in this problem you know that a force of _____ is applied in moving a bed.

(A.) 32 newtons
B. 32 joules
C. 4 meters per second

You also know that the bed had a mass of _____.

A. 32 newtons
B. 32 kilograms
(C.) 55 kilograms

Fill in the blanks.

TUTOR: Check your partner's answers. The correct answers are given below.

9. A force of 105 newtons is applied to a crate. The crate has a mass of 6 kilograms. At what rate will it accelerate?

10. A chair with a mass of 6 kilograms is accelerated at a rate of 2 meters per second squared. How many newtons of force were applied to the chair?

Rearrange these parts to make a complete word problem.

TUTOR: Check your partner's answers with the correct answers given below.

11. will the object accelerate?
with a mass of 11.1 kilograms,
If a force of 111 newtons
at what rate
is applied to an object

ANSWER: If a force of 111 newtons is applied to an object with a mass of 11.1 kilograms, at what rate will the object accelerate?

12. acted on it?
of 1.6 kilograms accelerates
A ball with a mass
at a rate of 2.3 meters/second^2.
How much force

ANSWER: A ball with a mass of 1.6 kilograms accelerates at a rate of 2.3 meters/second^2. How much force acted on it?

Read the information given and tell what you think the problem should ask.

TUTOR: Listen as your partner reads the problem and fills in the missing question. The answers are printed below. Your partner's answers don't have to match the printed answers exactly. When your partner's answer is different from the printed answer, make sure they mean the same thing.

13. A stack of newspapers with a mass of 9.6 kilograms is accelerated at a rate of .5 meters per second each second.

    What force was applied to the stack of newspapers?

14. A shopper applies a force of 9 newtons to a shopping cart. The cart has a mass of 3 kilograms.

    At what rate does the shopping cart accelerate?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

15. With how much force was a certain box kicked if it accelerated at a rate of 2.3 meters per second squared and had a mass of 1.1 kilograms?

What are you looking for in this problem?

A. the speed of the box
B. the box's mass
(C.) the force applied to the box

Which formula will you need?

A. F=W/d
B. F=m x a
(C.) F= m/a

16. If a force of 31 newtons is applied to a cannon ball and the ball's mass is 4 kilograms, at what rate does the ball accelerate?

What are you looking for in this problem?
- A. the distance the ball was thrown?
- B. the ball's average speed
- (C) the ball's acceleration

Write the formula you will need.
a = F/m

17. How much force is necessary to accelerate an arrow with a mass of 3 kilograms at a rate of .3 meters per second squared?

To find the force, you will have to _____ 3 kilograms by the acceleration.
- A. increase
- (B) multiply
- C. divide

The correct answer is B. The formula that involves force, mass, and acceleration if F = m x a or force = mass x acceleration. To find force, you multiply the mass by the acceleration.

If your partner is having difficulty, remind him/her that all you need to do is find the best formula for each word problem and put it in the proper form. The proper form means putting what you need to find on the left. After that, answering these questions is easy.

18. A force of 87 newtons is applied to an object. How fast will the object accelerate if it has a mass of 2.2 kilograms?

What does this problem ask you to find?
- (A) the object's acceleration
- B. the object's mass
- C. the distance the object will travel

What do you know from reading this problem?
- A. the rate of acceleration of the object
- (B) the object's mass
- C. the distance the object will travel

In this problem, the object's rate of acceleration is equal to
(A) 87 newtons divided by the object's mass
B. 2.2 kilograms multiplied by the force that acted on the object
C. the object's mass divided by 87 newtons

The correct answer is A. This problem gives you force and mass and asks for acceleration. The formula that involves these is F = m x a. Because you are looking for acceleration (a), it might be helpful to rewrite the formula as a = F/m. Acceleration is equal to force divided by mass.

If your partner is having difficulty, remind him/her that once you have the right formula in the right form (what you are looking for is on the left), variables stand for numbers. In #18 F equals force and force equals 87 newtons. M equals mass and mass equals 2.2 kilograms. So F and m are general ways of talking about things. 87 newtons and 2.2 kilograms are specific values that relate to a specific word problem. This is good to know whenever you are solving word problems.

19. If a book has a mass of 1.2 kilograms and it is accelerated at the rate of 2 meters per second squared, how much force was applied?

What does this problem ask you to find?
A. the speed of the book
B. the distance the book traveled
(C.) the force applied to the book

What information does this problem give you?
(A.) the book's rate of acceleration
B. the speed of the book
C. the force applied to the book

In this problem, the force applied to the book is equal to
A. the mass of the book divided by the acceleration
B. the speed of the book multiplied by the book's mass
(C.) the book's mass times 2 meters per second squared

The correct answer is C. This problem gives you mass and acceleration and asks for force. The formula you should use is F = m x a. Force is equal to mass times acceleration.

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

TUTOR: Listen as your partner reads the problem and decides whether enough information, too much information, or just the right amount of information is given. Explanations are given so you can help your partner.

20. A bowling ball hit a bowling pin with a force of 32 newtons. At what rate did the bowling pin accelerate?

NOT ENOUGH

The problem needs to tell the bowling pin's mass.

21. A hockey stick hits a hockey puck with a force of 212 newtons. The puck accelerates at a rate of 3 meters per second squared. What is the mass of the puck?

JUST RIGHT

22. A place kicker is running at a speed of 3 kilometers per hour. His foot hits the ball with a force f 100 newtons. The football accelerates toward the goal posts at the rate of 5 meters/sec^2. What is the mass of the football?

TOO MUCH

You don't need to know the speed of the place kicker.

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

23. 202 newtons of force is applied to an object. If the object accelerates at the rate of 3.7 meters per second each second, what is its mass?

What are you looking for in this problem?
(A) the object's mass
B. the object's speed
C. the rate of the object's acceleration

Which equation will you need?
A. m = S x d
B. m = F x a
(C.) m = F/a

After filling in all the numbers you can, what does the equation look like?
m = 202N/3.7 m/s2

24. A marble is shot out of a child's hand with a force of .26 newtons. At what rate will the marble accelerate if its mass is 7 grams?

What are you looking for in this problem?
A. the distance the marble will travel
(B.) the marble's acceleration
C. the force applied to the marble

Which formula will you need?
A. a = F x d
(B.) a = m/F
C. a = F/m

After filling in all the numbers you can, what does the equation look like?
a = .26 N/7 g

Your partner might have difficulty with this problem. Remember that one newton is the amount of force needed to accelerate one kilogram at the rate of one meter per second squared. The mass of the marble is given in grams. The mass must be converted into kilograms or else the answer will be wrong.

25. A child swings a bat and hits a ball that has a mass of 1.2 kilograms. The ball accelerated at a rate of 13 meters per second squared. How much force was exerted on the ball?

What was the ball's mass?
- (A) 1.2 Kg
- B. 1.2 m
- C. 13 m

13 meters per second squared is the ball's
- A. distance
- B. speed
- (C.) acceleration

What does this problem ask you to find?
- A. How much the ball weighed
- (B.) The ball's rate of acceleration
- C. The ball's mass

To solve this problem you need to know how fast the ball accelerated and _____.
- A. the mass of the bat
- (B) the mass of the ball
- C. the speed of the bat

Which formula will you need to solve this problem?
- A. m = D x v
- B. F = W / d
- (C.) F = m x a

To find the amount of force that acted on te ball, you will have to _____ 1.2 Kg by 13 m/sec².
- (A.) multiply
- B. divide
- C. increase

After filling in all the numbers you can, what does the equation look like?

F = 1.2 Kg x 13 m/sec²

IV. $W = F \times d$

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

TUTOR: Check your partner's answers to see if they match the ones given below.

1. What does the d stand for in this formula?
   A. density
   B. deceleration
   (C.) distance

2. What does the F stand for in this formula?
   (A.) force
   B. formula
   C. frequency

3. What does the W stand for in this formula?
   A. wavelength
   B. weight
   (C.) work

4. What is the unit of measurement for force?
   (A.) newton
   B. joule
   C. meter/second^2

5. What is the base unit of measurement for distance?
   A. kilometer
   (B.) meter
   C. centimeter

6. What is the unit of measurement for work?
   A. kilogram x meter
   B. newton
   (C.) newton x meter

7. What is another name for newton x meter?
   A. acceleration
   B. force
   (C.) joule

$W = F \times d$

8. In this formula, work is shown in terms of what two measurements?
   A. force and distance
   B. speed and distance
   C. force and density

9. How would you re-arrange this formula to show force in terms of work and distance?
   A. $F = W \times d$
   B. $F = W/d$
   C. $F = d/W$

10. How would you re-arrange the formula to show distance in terms of force and work?
   A. $d = W \times F$
   B. $d = W/F$
   C. $d = F/W$

11. Which of the following statements is true? Explain your answer.
   A. If the force increases, then the distance will also increase.
   B. If the force increases and the distance stays the same, then the work will increase.
   C. If the distance increases, then the force will also increase.

12. What happens to force if work increases but the distance stays the same? Explain your answer.
   A. Force will stay the same.
   B. Force will decrease.
   C. Force will increase.

13. What will happen to the value of d if the force gets larger and larger? Explain your answer.
   A. The value of d will stay the same.
   B. The value of d will decrease.
   C. The value of d will increase.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

1. A firefighter applies a force of 40 newtons in moving a hose 4 meters. How much work is done?

What moved 4 meters?

A. a force
B. a firefighter
(C.) a hose

How much force was exerted?

(A.) 40 newtons
B. 4 newtons
C. 4 meters

2. If 200 joules of work is done and 120 newtons of force is applied to a large rock, how far will the rock move?

How much force was applied?

A. 120 joules
B. 200 newtons
(C.) 120 newtons

How much work was done in moving the rock?

(A.) 200 joules
B. 120 joules
C. 120 newtons

3. 650 joules of work was done in moving a sofa 20 meters. How much force was applied to the sofa?

What is this problem asking you to find?
- (A.) the force applied to the sofa
- B. the mass of the sofa
- C. the rate of acceleration of the sofa

To solve this problem, you need to know how far the sofa was moved and
- A. the mass of the sofa
- B. the speed of the sofa
- (C.) the amount of work done

The correct answer is C. This problem doesn't give you the mass of the sofa or the speed of the sofa, but these things won't help you figure out the force applied to the sofa. To solve this problem you must know how far the sofa moved and the amount of work done.

4. How much work was done if a force of 175 newtons was applied in moving a piano 9 meters?

What does this problem ask you to find?
- A. the rate of acceleration
- B. the mass of the piano
- (C.) the amount of work done

To reach the solution, you need to know
- A. mass and acceleration
- B. force and mass
- (C.) force and distance

The correct answer is C. This problem gives you values for force and distance and asks you to find a value for work. You don't need to know mass or acceleration to find work. Besides, the problem doesn't tell you anything about mass or acceleration.

5. A file cabinet moves 2.2 meters when 375 joules of work are done.
Which question best completes this word problem?
- A. What is the mass of the file cabinet?
- (B.) How much force was applied to the file cabinet?
- C. What is the average speed of the file cabinet?

The correct answer is B. This problem gives you values for distance and work. There is one formula that involves distance and work: $W = F \times d$. The missing value is force, so that must be what you are supposed to find.

6. How much work is done if 60 newtons of force is applied to a crate of oranges, moving the crate .04 meters?

How far has the crate moved?
   A. 4 meters
   (B.) .04 meters
   C. 60 meters

How much force is applied?
   (A.) 60 newtons
   B. 60 meters
   C. .04 newtons

7. The perimeter of a room is 32 meters. How much work will be done in pushing a vacuum cleaner around the room if a force of 51 newtons is applied to the vacuum cleaner?

What is the distance the vacuum cleaner will move?
   A. 51 meters
   (B) 32 meters
   C. 32 newtons

51 newtons is
   A. the weight of the vacuum cleaner
   B. the amount of work done
   (C) the force applied to the vacuum cleaner

8. If 88 newtons of force is applied to a desk and 132 joules of work is done, how far will the desk move?

From the information given in this problem, you know that _____ of work was done.
   A. 132 newtons
   (B) 132 joules
   C. 88 joules

This problem also tells you that _____ was applied to the desk.
   (A.) 88 newtons of force
   B. 132 joules of work
   C. 132 newtons of force

Fill in the blanks.

TUTOR: Check your partner's answers. The correct answers are given below.

9. A force of 58 newtons is applied in lifting a lamp .7 meters. How much work is done?

10. If 2200 joules of work is done in pulling a cart 32 meters, how much force was applied?

Rearrange these parts to make a complete word problem.

TUTOR: Check your partner's answers with the correct answers given below.

11. that weighs 35 newtons
Suppose you lift a box
work was done?
How much
a distance of 21 millimeters.

ANSWER: Suppose you lift a box that weighs 35 newtons a distance of 21 millimeters. How much work was done?

12. how far will
If 325 joules of work
is applied to a hat rack,
the hat rack be moved?
is done, and 77 newtons of force

ANSWER: If 325 joules of work is done, and 77 newtons of force is applied to a hat rack, how far will the hat rack be moved?

Read the information given and tell what you think the problem should ask.

TUTOR: Listen as your partner reads the problem and fills in the missing question. The answers are printed below. Your partner's answers don't have to match the printed answers exactly. When your partner's answer is different from the printed answer, make sure they mean the same thing.

13. 320 joules of work is done and a force of 62 newtons is applied to a desk.

    How far does the desk move?

14. A force of 24 newtons is applied to a garbage bag full of leaves. The bag moves 13 meters.

    How much work was done in moving the bag?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

15. 83 joules of work is done in lifting a bicycle. If the bicycle is lifted .8 meters, how many newtons does the bike weigh?

What does this problem ask you to find?

A. the mass of the bike
B. the force applied to the bike
(C.) the weight of the bike in newtons

Which formula will you need?

A. F = W x d
(B.) F = W/d
C. F = m x a

16. How much work is done if a force of 72 newtons is applied to a chair, pushing the chair 3.7 meters?

What does this problem ask you to find?
A. the force applied in lifting the chair
B. the force applied in pushing the chair
(C.) the amount of work done

Write the formula you will need.
W = F x d

17. An object moves .83 meters when 27 newtons of force is applied. How much work was done?

To find the amount of work done, you must multiply 27 newtons by _____.
A. the mass of the object
(B.) the distance the object moves
C. the volume of the object

The correct answer is B. The formula that uses distance, force, and work is W = F x d. To find out how much work was done, you must multiply the force by the distance.

18. How much work is done in lifting a pumpkin 1.2 meters if the pumpkin weighs 49 newtons?

What are you looking for in this problem?
A. the mass of the pumpkin
(B.) the amount of work done in lifting the pumpkin
C. the speed of the pumpkin

What does this problem tell you?
A. The pumpkin is rolled 1.2 meters.
(B.) The pumpkin is lifted 1.2 meters.
C. The pumpkin's mass is 1.2 kilograms.

In this problem, the amount of work done is equal to
A. 49 newtons divided by 1.2 meters
B. the pumpkin's mass divided by 49 newtons
(C.) 1.2 meters multiplied by 49 newtons

The correct answer is C. The problem gives you distance and force and asks for work. The formula you should use is W = F x d. Work is equal to force multiplied by distance.

19. If 200 joules of work is done and 120 newtons of force is applied to a large rock, how far will it move?

What are you looking for in this problem
   A. the speed of the rock
   B. the rock's rate of acceleration
   (C.) the distance the rock will move

What do you know from reading this problem?
   A. the mass of the rock
   (B.) the amount of work that was done
   C. the distance the rock will move

In this problem, the distance the rock will move is equal to
   A. the work done multiplied by 120 newtons
   (B.) 200 joules divided by the force applied to the rock
   C. the acceleration divided by 200 joules

The correct answer is B. The problem gives you work and force and asks you to find distance. The formula you should use is W = F x d. Because you are looking for distance (d), it might be helpful to rewrite the formula as d = W/F. Distance equals work divided by force.

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

TUTOR: Listen as your partner reads the problem and decides whether enough information, too much information, or just the right amount of information is given. Explanations are given so you can help your partner.

20. How much work is done in swimming 50 meters in a swimming pool?

NOT ENOUGH

The problem needs to tell the amount of force used.

21. 925 joules of work is done in carrying a bale of hay. The bale weighs 185 newtons and has a volume of .336 cubic meters. How far was the bale carried?

TOO MUCH

The volume of the hay bale is unnecessary.

22. A student uses 1 newton of force in moving a pencil 1 meter. How much work does the student do?

JUST RIGHT

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

23. A crane is lifting construction materials. How high does it lift a load if 1879 joules of work is done and the load weighs 817 newtons?

What does this problem ask you to find?

A. the mass of the load
(B) the distance the load was lifted
C. the force applied to the building materials

Which formula will you need?

(A) $d = W/F$
B. $d = W \times F$
C. $d = W \times m$

After filling in all the numbers you can, what does the equation look like?

$d = 1879\ J/817\ N$

Even though the unit of distance is meters (m), it might not be clear how you end up with meters if you're working with joules and newtons. Remember that the unit of work, joules, is equal to N x m and that is equal to $\frac{Kg \times m^2}{sec^2}$. The unit of force is newtons and that equals $\frac{Kg \times m}{sec^2}$. So J/N equals $\frac{Kg \times m^2/sec^2}{Kg \times m/sec^2}$. After you cancel out the terms that appear both on the top and the bottom of the fraction, you're left with m.

24. In pushing a crate 9 meters, 411 joules of work was done. What force was applied to the crate?

What does this problem ask you to find?

A. the rate of acceleration
B. the force applied to the crate
C. the crate's mass

Which formula will you need?

A. F = W/d
B. F = d/W
C. F = W/a

After filling in all the numbers you can, what does the equation look like?

F = 411 J/9 m

The unit of force is newtons (N), but how do you get from joules (J) and meters (m) to newtons? Force equals work/distance or J/m. A joule is equal to N x m. So J/m equals N x m / m. When you cancel out the m on both sides of the fraction, you're left with newtons.

25. A worker applies a force of 52 newtons to a big crate and the crate moves 2.1 meters. How much work was done?

How far did the crate move?
- A. 52 meters
- (B) 2.1 meters
- C. 2.1 newtons

How much force was exerted?
- (A) 52 newtons
- B. 52 meters
- C. 2.1 newtons

What does this problem ask you to find?
- A. the weight of the crate
- (B) the amount of work that was done
- C. the distance the crate moved

To solve this problem, you need to know how far the crate moved and _____.
- (A) the weight of the crate
- B. the mass of the crate
- C. the force that the worker applied to the crate

Which formula will you need to solve this problem?
- (A) F = W x d
- B. W = F x d
- C. W = m x a

To find the amount of work that was done, you will have to _____ 2.1 meters by 52 newtons.
- A. divide
- B. decrease
- (C) multiply

After filling in all the numbers you can, what does this equation look like?

W = 52 N x 2.1 m

V. $D = m/v$

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

TUTOR: Check to see that your partner has the correct answers.

1. What does the m stand for in this formula?
   A. meter
   B. molecule
   (C.) mass

2. What does the v stand for in this formula?
   A. velocity
   (B.) volume
   C. voltage

3. What does the D stand for in this formula?
   (A.) density
   B. deceleration
   C. distance

4. What is the base unit of measurement for volume?
   (A.) liter
   B. milliliter
   C. gram

5. What is the base unit of measurement for mass?
   A. gram
   (B.) kilogram
   C. milliliter

6. What is the base unit of measurement for density?
   A. gram/meter (g/m)
   (B.) kilogram/liter (kg/L)
   C. newton/liter (N/L)

7. In this formula, density is shown in terms of what two measurements?
   A. matter and volume
   (B.) mass and volume
   C. mass and velocity

$D = m/v$

8. How would you re-arrange this formula to show mass in terms of volume and density?
   A. $m = D/v$
   B. $m = D \times v$
   C. $m = v/D$

9. How would you re-arrange this formula to show volume in terms of density and mass?
   A. $v = D \times m$
   B. $v = D/m$
   C. $v = m/D$

10. Which of the following statements is true? Explain your answer.
   A. If the volume decreases, then the density will increase.
   B. If the volume decreases, then the mass will also decrease.
   C. If the volume increases, then the density will also increase.

11. What would happen to the density if the mass decreased and the volume stayed the same? Explain your answer.
   A. The density would stay the same.
   B. The density would decrease.
   C. The density would increase.

12. What would make the value of m get larger? Explain your answer.
   A. If volume and density decreased, the value of m would increase.
   B. If volume stayed the same and density increased, the value of m would increase.
   C. If density decreased and the volume stayed the same, the value of m would increase.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

1. 20 milliliters of a solution has a mass of 45 grams. What is the density of the solution?

What is the volume of the solution?

A. 45 milliliters
(B.) 20 milliliters
C. 20 grams

What is the mass of the solution?

(A.) 45 grams
B. 20 grams
C. 20 milligrams

2. A bowl of soup has a mass of 300 grams. The density of the soup is 2.2 grams per milliliter. How much soup is in the bowl?

What is the mass of the soup in the bowl?

(A.) 300 grams
B. 2.2 grams
C. 300 milliliters

Besides mass, what else does this problem tell you about the soup?

A. its temperature
(B.) its density
C. its volume

What is the density of the soup?

A. 300 grams
(B.) 2.2 grams per milliliter
C. 2.2 grams per liter

3. 800 milliliters of orange juice has a density of 1.3 grams/milliliter. What is the mass of the orange juice?

What is this problem asking you to find?
A. the density of the juice
B. the mass of the juice
C. the temperature of the juice

To solve this problem, you need to know the density of the juice and
A. the kind of container the juice is in
B. the volume of the juice
C. the temperature of the juice

The correct answer is B. You need to know density and volume to find mass. This problem doesn't say what kind of container the juice is in or the temperature of juice. These things won't help you find mass.

4. A bunch of raisins having a mass of 50 grams and a volume of 24 cubic centimeters has what density?

What are you looking for in this problem?
A. the weight of the raisins
B. the density of the raisins
C. how many raisins there are

To reach the solution, you need to know
A. volume and mass
B. mass and temperature
C. weight and mass

The correct answer is A. To find density you need to know volume and mass. And the problem gives you volume and mass. The problem doesn't give you temperature or weight, but these won't help you find density.

5. A solution has a density of 3.1 grams per milliliter. The mass of the solution is 8 grams.

Which question completes this word problem?
A. What is the weight of the solution?
B. What is the temperature of the solution?
C. What is the volume of the solution?

The correct answer is C. This problem gives you values for density and mass. There is one formula that uses density and mass: D = m/v. You can use density and mass to find volume, but not weight or temperature.

6. If a bottle of vinegar has a volume of 750 milliliters and a mass of 730 grams, what is its density?

The mass of the vinegar is
(A.) 730 grams
B. 750 grams
C. 750 milliliters

The volume of the vinegar is
A. 730 grams
B. 750 grams
(C.) 750 milliliters

7. The density of ketchup is 2.3 grams per milliliter. What is the volume of 39 grams of ketchup?

39 grams is
A. the ketchup's mass
B. the ketchup's weight
(C.) the ketchup's volume

2.3 grams per milliliter is
(A.) the density of the ketchup
B. the mass of the ketchup
C. the volume of the ketchup

8. 40 milliliters of a solution is in a test tube. The density of this solution is 1.39 grams per milliliter. What is the mass of the solution in the test tube?

This problem gives you values for _____.
A. density and mass
B. mass and volume
(C.) volume and density

According to this problem, the volume of the solution in the test tube is _____.
A. 1.39 grams per milliliter
B. 1.39 milliliters
(C.) 40 milliliters

Fill in the blanks.

TUTOR: Check your partner's answers. The correct answers are given below.

9. The paint in a can has a mass of 450 grams. The density is 2.7 grams/milliliters. What is the volume?

10. 8.3 milliliters of a solution has a mass of 10.6 grams. What is the density of the solution?

Rearrange these parts to make a complete word problem.

TUTOR: Check your partner's answers with the correct answers given below.

11. The volume of this solution is
of 4.5 grams/milliliter.
7.8 milliliters.
What is the mass of the solution?
There is a solution with a density

ANSWER: There is a solution with a density of 4.5 grams/milliliter. The volume of the solution is 7.8 milliliters. What is the mass of the solution?

12. of the substance
a substance if 26.2 grams
What is the density of
has a volume of
5.1 milliliters?

ANSWER: What is the density of a substance if 26.2 grams of the substance has a volume of 5.1 milliliters?

Read the information given and tell what you think the problem should ask.

TUTOR: Listen as your partner reads the problem and fills in the missing question. The answers are printed below. Your partner's answers don't have to match the printed answers exactly. When your partner's answer is different from the printed answer, make sure they mean the same thing.

13. A carrot has a density of 2.3 grams per milliliter. The volume of the carrot is 42 milliliters.

    What is the mass of the carrot?

14. The juice in a 2 liter bottle has a mass of 2.3 kilograms.

    What is the density of the juice?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

15. The density of a mud puddle is 3.82 grams per milliliter. What is the mass of the mud puddle if its volume is 2.6 liters?

What are you looking for in this problem?

(A.) the mass of the mud puddle
B. the volume of the mud puddle
C. the temperature of the mud puddle

Which formula will you need?

A. m = D/v
(B.) m = D x v
C. M = a x D

16. A solution in a test tube has a volume of 12 milliliters. If the mass of the solution is 13.3 grams, what is its density?

What are you looking for in this problem?
- A. the weight of the solution
- (B) the density of the solution
- C. the temperature of the solution

Write the formula you will need.
D = m/v

17. What is the density of a glass of juice if 100 milliliters has a mass of 132 grams?

To find the density of the juice, you will have to divide 132 grams by _____.
- A. the temperature of the juice
- B. the mass of the juice
- (C.) the volume of the juice

The correct answer is C. The formula that uses mass, volume, and density is D = m/v. To find the density, you must divide the mass by the volume.

18. The jelly in a jar has a density of 2.1 grams per milliliter. What is the mass of 96 milliliters of jelly?

What does this problem ask you to find?
- (A) the mass of 96 milliliters of jelly
- B. the volume of a jar of jelly
- C. the mass of a jar of jelly

What does this problem tell you?
- (A) the volume of the jar
- B. the mass of one milliliter of jelly
- C. the mass of 96 milliliters of jelly

In this problem, the mass of 96 milliliters of jelly is equal to
- A. 96 milliliters divided by the density of the jelly
- B. the mass of the whole jar divided by 96
- (C.) the jelly's density multiplied by 96 milliliters

The correct answer is C. The problem gives you density and volume and asks for mass. The formula you should use is D = m/v, but it might be helpful to think of it as m = D x v. Mass equals density multiplied by volume.

19. A bowl of soup has a mass of 350 grams. The soup's density is 4.1 grams per milliliter. What is the volume of soup in the bowl?

What does this problem ask you to find?
- (A) the volume of the bowl of soup
- B. the mass of the soup
- C. the temperature of the soup

What does this problem tell you?
- A. the volume of the soup
- (B) the mass of the soup
- C. the temperature of the soup

In this problem, the volume of the soup is equal to
- A. 4.1 grams per milliliter divided by the mass of the soup
- B. 350 grams multiplied by the soup's density
- (C.) the soup's mass divided by 4.1 grams per milliliter

The correct answer is C. The problem gives you mass and density and asks for volume. The formula you should use is $D = m/v$. Because you're looking for volume, rewrite the formula as $v = m/D$. Volume equals mass divided by density.

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

TUTOR: Listen as your partner reads the problem and decides whether enough information, too much information, or just the right amount of information is given. Explanations are given so you can help your partner.

20. A can of peaches has a mass of 425 grams. What is the volume of half a can if the density of peaches is 3.8 grams per milliliter?

JUST RIGHT

21. A pig has a mass of 33 kilograms. The pig's volume is 30 liters. What is the pig's density?

JUST RIGHT

22. Sea water has a density of 1.33 grams per milliliter. It's boiling point is 90° C. What is the mass of sea water?

NOT ENOUGH & TOO MUCH

This problem does not give you enough information to solve the problem. You must have a specified volume of water to find the mass. However, the problem also gives you unnecessary information. The boiling point of the water is not necessary.

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

23. A bowl of ice cream has a density of 2.8 grams per milliliter. What is the volume of the ice cream if its mass is 82 grams?

What are you looking for in this problem?

A. the ice cream's density
B. the mass of the ice cream
(C.) the ice cream's volume

Which formula will you need?

A. v = m/D
B. v = m x D
(C.) v = D/m

After filling in all the numbers you can, what does the equation look like?

v = 82 g/2.8 g per mL

24. If a board has a mass of 1.7 kilograms and a volume of 620 milliliters, what is the board's density?

What are you looking for in this problem?

A. the board's length
B. the board's density
C. the board's mass

Which formula will you need?

A. D = t x S
B. D = v/m
C. D = m/v

After filling in all the numbers you can, what does the equation look like?

D = 1.7 kg/620 mL

25. 36 milliliters of a solution has a mass of 39 grams. What is the solution's density?

What is the volume of the solution?
(A) 36 milliliters
B. 39 grams
C. 39 milliliters

What is the solution's mass?
A. 36 milliliters
(B.) 36 grams
C. 39 grams

What does this problem ask you to find?
(A.) the mass of the solution
B. the weight of the solution
C. the density of the solution

To solve this problem, you need to know the mass of the solution and _____.
(A.) the volume of the solution
B. the weight of the solution
C. the temperature of the solution

Which formula will you need to solve this problem?
A. D = m x a
(B.) D = m / v
(C.) D = m x v

To find the solution's density, you will have to _____ 39 grams by 36 milliliters.
A. decrease
(B) divide
C. multiply

After filling in all the numbers you can, what does this equation look like?
D = 39 g / 36 mL

VI. speed = wavelength x frequency

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

TUTOR: Check to see that your partner has the correct answers.

1. What is the unit of measurement for wavelength?
   A. second
   (B.) meter
   C. kilometer

2. What is the unit of measurement for frequency?
   A. second
   B. second^2
   (C.) 1 cycle/second

3. What is another name for 1 cycle/second?
   (A.) hertz
   B. sound
   C. vibration

4. How would you re-arrange this formula to show wavelength in terms of speed and frequency?
   A. wavelength = frequency/speed
   B. wavelength = speed x frequency
   (C.) wavelength = speed/frequency

5. How would you re-arrange this formula to show frequency in terms of wavelength and speed?
   (A.) frequency = speed/wavelength
   B. frequency = wavelength/speed
   C. frequency = speed x wavelength

6. Which of the following statements is true? Explain your answer.
   A. If wavelength and frequency decrease, speed will increase.
   B. If wavelength decreases and frequency stays the same, then speed will increase.
   (C.) If wavelength increases and frequency stays the same, then speed will increase.

speed = wavelength x frequency

7. What would happen to speed if wavelength decreased and frequency stayed the same? Explain your answer.
   A. Speed would stay the same.
   (B.) Speed would decrease.
   C. Speed would increase.

8. What would make the frequency get larger? Explain your answer.
   (A.) If the speed increased and the wavelength stayed the same, the frequency would get larger.
   B. If the speed decreased and the wavelength stayed the same, the frequency would get larger.
   C. If the wavelength increased and the speed stayed the same, the frequency would get larger.

9. What would happen to the wavelength if the frequency got larger and the speed stayed the same? Explain your answer.
   A. Wavelength would stay the same.
   (B.) Wavelength would decrease.
   C. Wavelength would increase.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

1. A television station broadcasts a long tone as part of its Emergency Broadcast System. If the tone has a frequency of 300 hertz and a wavelength of .5 meters, how fast is the wave going?

Where does the tone come from?
- A. the telephone
- (B.) a television station is broadcasting it
- C. the radio

What is the frequency of the wave?
- (A.) 300 Hz
- B. .5 Hz
- C. .5 meters

Besides frequency, what else does this problem tell you about the sound?
- A. volume
- B. speed
- (C.) wavelength

2. What is the frequency of a sound that moves 410 meters a second and has a wavelength of 6.5 meters?

What is the speed of these soundwaves?
- A. 63 meters a second
- B. 6.5 meters a second
- (C.) 410 meters a second

6.5 meters is
- (A.) the wavelength
- B. the frequency
- C. the speed

3. A violin produces a tone with a frequency of 440 hertz. If the speed of the sound waves is 320 meters per second, what is the wavelength?

What are you looking for in this problem?
A. the source of the sound
B. the amplitude
(C.) the wavelength

To solve this problem, you need to know the speed and
A. the amplitude
(B.) the frequency
C. the source of the sound

The correct answer is B. You need to know speed and frequency. The problem doesn't tell you anything about amplitude or the source of the sound. There is one formula in this workbook that has to do with wavelength: speed = wavelength x frequency.

4. What is the frequency of a sound that has a wavelength of .9 meters and moves at a speed of 287 meters per second?

What does this problem ask you to find?
A. amplitude
(B.) frequency
C. speed

To reach the solution, you need to know
A. wavelength and amplitude
B. amplitude and speed
(C.) speed and wavelength

The correct answer is C. The problem asks you to find frequency. Amplitude won't help you find frequency. To find frequency, you need to know speed and wavelength.

5. A sound has a frequency of 395 hertz. Its wavelength is .75 meters.

Which question best completes this word problem?
(A.) How fast are the soundwaves moving?
B. How loud is the sound?
C. What is the amplitude of the soundwaves?

The correct answer is A. This problem gives you frequency and wavelength. There is one formula that involves frequency and wavelength: speed = frequency x wavelength. You can use the values given to find speed, but not loudness or amplitude.

6. What is the frequency of a horn if the speed of the soundwaves is 373 meters per second and the wavelength is 1.8 meters?

373 meters per second is the sound's
A. wavelength
B. speed
C. frequency

1.8 meters is the sound's
A. amplitude
B. wavelength
C. speed

7. A sound has a frequency of 524 hertz and a speed of 389 meters per second. What is the wavelength?

What is the frequency of the sound?
A. 389 meters
B. 524 hertz
C. 524 meters

How fast is the sound moving?
A. 524 meters
B. 389 meters
C. 389 meters per second

8. How fast is a sound going if it has a frequency of 354 hertz and a wavelength of 3.54 meters?

In this problem, you are told that the _____ is 3.54 meters.
A. wavelength
B. speed
C. frequency

You also know that 354 _____ is the frequency.
A. meters per second
B. hertz
C. meters

Fill in the blanks.

TUTOR: Check your partner's answers. The correct answers are given below.

9. If the frequency of a certain sound is 440 hertz and the wavelength is 1.7 meters, then what is its speed?

10. What is the frequency of a sound if its wavelength is .97 meters and its speed is 385 meters/second?

Rearrange these parts to make a complete word problem.

TUTOR: Check your partner's answers with the correct answers given below.

11. If a sound has a frequency of
speed of the wave?
491 hertz and a wavelength of
what is the
1.75 meters,

ANSWER: If a sound has a frequency of 491 hertz and a wavelength of 1.75 meters, what is the speed of the wave?

12. 333.3 meters/second and it has
its speed is
What is the frequency of the sound?
Suppose there is a sound and
a wavelength of 3.3 meters.

ANSWER: Suppose there is a sound and its speed is 333.3 meters/second and it has a wavelength of 3.3 meters. What is the frequency of the sound?

Read the information given and tell what you think the problem should ask.

TUTOR: Listen as your partner reads the problem and fills in the missing question. The answers are printed below. Your partner's answers don't have to match the printed answers exactly. When your partner's answer is different from the printed answer, make sure they mean the same thing.

13. A car's horn has a frequency of 640 hertz. When the horn is sounded, the waves move at a speed of 381 meters per second.

    What is the wavelength?

14. A sound has a speed of 388 meters per second and a wavelength of 2.5 meters.

    What is the frequency of the sound?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

15. A flute plays a sound with a frequency of 330 hertz. The wavelength is .8 meters. What is the speed of the sound waves?

What does this problem ask you to find?

A. the volume of the sound
(B) the speed of the sound waves
C. the frequency of the sound

Which formula will you need?

A. speed = d/t
B. speed = frequency/wavelength
(C.) speed = wavelength x frequency

16. When a drum is banged, the wavelength of the sound waves is 1.68 meters. What is the frequency of the sound if the speed of the soundwaves is 388 meters per second?

What does this problem ask you to find?
(A) frequency
B. amplitude
C. speed

Write the formula you will need.
frequency = speed/wavelength

17. If a sound has a frequency of 603 hertz and a speed of 412 meters per second, what is the wavelength?

To find the wavelength, you will have to _____ the speed by 603 hertz.
(A) divide
B. decrease
C. multiply

The correct answer is A. The formula that involves frequency, speed, and wavelength is speed = wavelength x frequency. This is equal to wavelength = speed/frequency. To find the wavelength, you must divide the speed by the frequency.

18. A singer sings a note with a frequency of 494 hertz. The speed is 385 meters per second. What is the wavelength?

What does this problem ask you to find?
A. the speed of the sound
(B) the wavelength of the sound wave
C. the amplitude of the sound

What do you know about this problem?
A. the frequency is 385 hertz
(B) the speed is 385 meters per second
C. the wavelength is .08 meters

In this problem, the wavelength is equal to
(A) the speed of the soundwaves divided by 494 hertz
B. the frequency divided by 385 meters per second
C. the speed of the soundwaves divided by 385 hertz

The correct answer is A. The problem gives you frequency and speed and asks for wavelength. The formula you should use is speed = wavelength x frequency. Because you're looking for wavelength, it might be helpful to rewrite this formula as wavelength = speed/frequency. Wavelength is equal to the speed divided by the frequency.

19. What is the frequency of a sound that moves 339 meters in a second and has a wavelength of 1.36 meters?

What are you looking for in this problem?
- A. the frequency
- B. the amplitude
- C. the wavelength

After reading this problem, what do you know?
- A. the speed is 339 miles an hour
- B. the speed is 1.36 meters a second
- C. the speed is 339 meters a second

In this problem, the frequency is equal to
- A. 1.36 meters times 339 meters per second
- B. the amplitude divided by 1.36 meters
- C. 339 meters per second divided by the wavelength

The correct answer is C. The problem gives you speed and wavelength and asks for frequency. The formula you should use is speed = wavelength x frequency. Because you're looking for frequency, rewrite this formula as frequency = speed/wavelength. Frequency equals speed divided by wavelength.

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

TUTOR: Listen as your partner reads the problem and decides whether enough information, too much information, or just the right amount of information is given. Explanations are given so you can help your partner.

20. What is the frequency of a train whistle if the wavelength is .88 meter?

NOT ENOUGH

The problem needs to give the speed of the sound waves.

21. The frequency of the school bell that rings every 50 minutes is 524 hertz. The wavelength is 1.5 meters and the amplitude is .8 meters. What is the speed?

TOO MUCH

You don't need to know how often the bell rings or the amplitude of the sound waves.

22. An x-ray travels at a speed of 200 m/sec. It has a wavelength of .5 m. What is the frequency?

JUST RIGHT

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

23. The frequency of a whistle is 612 hertz. If the speed of the sound waves is 399 meters per second, what is the wavelength?

What does this problem ask you to find?
A. the speed of the soundwaves
(B) the wavelength of the soundwaves
C. the frequency of the soundwaves

Which formula will you need?
A. wavelength = speed x frequency
(B.) wavelength = speed/frequency
C. wavelength = frequency x amplitude

After filling in all the numbers you can, what does the equation look like?
wavelength = 399 m per s/612 Hz

24. How fast does the sound of a car's squeaking brakes travel if the frequency of the sound is 708 hz and the wavelength is 1.3 meters?

What does this problem ask you to find?
A. the volume of the sound
(B.) the speed of the soundwaves
C. the speed of the car

Which formula will you need?
A. speed = distance/time
B. speed = wavelength/frequency
(C.) speed = frequency x wavelength

After filling in all the numbers you can, what does the equation look like?
speed = 708 hz x 1.3 m

25. A musical instrument makes a sound that has a frequency of 440 hertz and a wavelength of .86 meters. How fast is the wave going?

What is the frequency of the sound?
- A. .86 meters
- B. .86 hertz
- (C.) 440 hertz

What is the wavelength?
- A. 440 hertz
- B. .86 hertz
- (C.) .86 meters

What does this problem ask you to find?
- A. the volume of the sound
- (B) the speed of the wave
- C. the frequency of the sound

To solve this problem, you need to know the wavelength and the _____.
- A. amplitude
- B. volume
- (C.) frequency

Which formula will you need to solve this problem?
- A. speed = wavelength x frequency
- (B) speed = wavelength / frequency
- C. speed = wavelength x amplitude

To find the wave's speed, you will have to _____ .86 meters by 440 hertz.
- A. increase
- B. divide
- (C.) multiply

After filling in all the numbers you can, what does this equation look like?

speed = .86 m x 440 Hz

VII. $I = V/R$

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

TUTOR: Check to see that your partner has the correct answers.

1. What does the R stand for in this formula?
   A. radiation
   (B.) resistance
   C. rate

2. What does the V stand for in this formula?
   (A.) voltage
   B. volume
   C. velocity

3. What does the I stand for in this formula?
   A. inertia
   B. Celsius
   (C.) current

4. What is the unit of measurement for voltage?
   A. watt
   (B.) volt
   C. ohm

5. What is the unit of measurement for resistance?
   A. watt
   B. volt
   (C.) ohm

6. What is the unit of measurement for current?
   A. ohm (Ω)
   (B.) volts/ohm (V/Ω)
   C. volts/meter (V/m)

7. What is another name for volts/ohm?
   A. watt
   (B.) ampere
   C. electricity

8. What two measurements define current in this formula?
   (A.) resistance and voltage
   B. voltage and rate
   C. volume and resistance

$I = V/R$

9. How would you re-arrange this formula to show resistance in terms of current and voltage?
   A. $R = V/I$
   B. $R = I/V$
   C. $R = V \times I$

10. How would you re-arrange this formula to show voltage in terms of current and resistance?
   A. $V = I/R$
   B. $V = I \times R$
   C. $V = R/I$

11. Which of the following statements is true? Explain your answer.
   A. If the voltage increases, then the current will decrease.
   B. If the voltage increases, then the current will also increase.
   C. If the voltage increases, then the resistance will decrease.

12. What would make the value of I get larger? Explain your answer.
   A. If the resistance got smaller and the voltage stayed the same, then the value of I would get larger.
   B. If the voltage got smaller and the resistance stayed the same, then the value of I would get larger.
   C. If the resistance got larger and the voltage stayed the same, then the value of I would get larger.

13. What happens to V when I increases and R stays the same? Explain your answer.
   A. V stays the same.
   B. V decreases.
   C. V increases.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

1. What is the current through a resistance of 10 ohms when a 24 volt battery is used?

What is the resistance of the conductor?
   A. 10 ohms
   B. 24 volts
   C. 2.4 amperes

What does this problem say about the battery?
   A. The problem mentions the battery's mass.
   B. The problem mentions the battery's voltage.
   C. The problem mentions the battery's resistance.

2. If a current running through a conductor is .86 amperes and a 12 volt battery is used, what is the resistance of the conductor?

What is the voltage of the battery?
   A. 12 volts
   B. .86 volts
   C. 12.86 volts

What is the current?
   A. 12 amperes
   B. .86 volts
   C. .86 amperes

3. What is the voltage of the battery if a current of 1.5 amperes passes through a conductor with a resistance of 11 ohms?

What is this problem asking you to find?
   A. the battery's voltage
   B. the battery's mass
   C. the battery's resistance

To solve this problem, you need to know resistance and

A. current
B. speed
C. the mass of the battery

The correct answer is A. You need to know resistance and current in order to find voltage. The problem doesn't give you speed or the mass of the battery, but these things won't help you find voltage.

4. If a current of 1.3 amperes passes through a conductor and a 9 volt battery is used, what is the resistance of the conductor?

What are you looking for in this problem?

A. resistance
B. voltage
C. speed

To reach the solution, you need to know

A. voltage and speed
B. current and voltage
C. current and mass

The correct answer is B. To find resistance you need to know current and voltage. The problem gives you values for current and voltage. The problem doesn't give you values for speed or mass, but these things won't help you find resistance.

5. A conductor has a resistance of 50 ohms. A 9 volt battery is used.

A. What is the mass of the battery?
B. What current passes through the conductor?
C. What is the speed of the current?

The correct answer is B. This problem gives you values for resistance and voltage. There is one formula that uses resistance and voltage: $I = V/R$. Current is the missing value. You can use resistance and voltage to find current, but not mass or speed.

6. What is the potential difference if a conductor's resistance is 95 ohms and a current of 4.7 amperes passes through that conductor?

The resistance of the conductor is
- A. 95 ohms
- B. 4.7 ohms
- C. 47 ohms

4.7 amperes is the
- A. speed
- B. resistance
- C. current

7. If a current of 7.77 amperes passes through a conductor and the potential difference is 24 volts, what is the conductor's resistance?

What is the current?
- A. 24 volts
- B. 24 amperes
- C. 7.77 amperes

What is the potential difference?
- A. 24 volts
- B. 24 amperes
- C. 7.77 volts

8. What current passes through a conductor with a resistance of 10 ohms and a potential difference of 12.3 volts?

What do you know from reading this problem?
- A. potential difference and resistance
- B. resistance and current
- C. current and potential difference

This problem tells you that the resistance is _____.
- A. 12.3 ohms
- B. 12.3 volts
- C. 10 ohms

Fill in the blanks.

TUTOR: Check your partner's answers. The correct answers are given below.

9. What is the current running through a conductor if a 12 volt battery is used and the resistance is 12 ohms?

10. A current of .35 amperes passes through a conductor with a resistance of 80 ohms. What is the voltage of the battery used?

Rearrange these parts to make a complete word problem.

TUTOR: Check your partner's answers with the correct answers given below.

11. what is the resistance of the conductor?
through a conductor.
If a 12 volt battery is used,
There is a current
of .8 amperes running

ANSWER: There is a current of .8 amperes running through a conductor. If a 12 volt battery is used, what is the resistance of the conductor?

12. if there is a current
of 1.2 amperes?
What is the voltage of the battery
a resistance of 120 ohms.
A conductor has

ANSWER: A conductor has a resistance of 120 ohms. What is the voltage of the battery if there is a current of 1.2 amperes?

Read the information given and tell what you think the problem should ask.

TUTOR: Listen as your partner reads the problem and fills in the missing question. The answers are printed below. Your partner's answers don't have to match the printed answers exactly. When your partner's answer is different from the printed answer, make sure they mean the same thing.

13. A conductor has a resistance of 25 ohms. A current of 1.6 amperes passes through this conductor.

    What is the voltage of the battery?

14. A current of .49 amperes passes through a conductor. A 24 volt battery is being used.

    What is the resistance of the conductor?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

15. What is the current passing through a conductor if the resistance of the conductor is 77 ohms and the potential difference is 8.5 volts?

What are you looking for in this problem?

A. voltage
(B.) current
C. mass

Which formula will you need?

(A.) $I = V/R$
B. $I = V \times R$
C. $I = m \times P$

16. What is the resistance of a conductor if the potential difference is 11 volts and 5.3 amperes of current passes through the conductor?

What are you looking for in this problem?
A. the potential difference
B. the conductor's mass
C. the conductor's resistance

Write the formula you will need.
R = V/I

17. A current of 7.9 amperes passes through a conductor with a resistance of 30 ohms. What is the potential difference?

To find the potential difference, you will have to _____ 30 ohms by 7.9 amperes.
A. multiply
B. increase
C. divide

The correct answer is A. The formula that uses current, resistance, and potential difference (voltage) is I = V/R. Since you are looking for potential difference, it might be helpful to write the formula as V = R x I. To find potential difference, you must multiply the resistance by the current.

18. What is the resistance of a conductor when a 9 volt battery is used and a current of 2.5 amperes passes through the conductor?

What are you looking for in this problem?
A. the mass of the battery
B. the resistance of the battery
C. the resistance of the conductor

What do you know from reading this problem?
A. the battery's current
B. the battery's voltage
C. the speed of the current

In this problem, the resistance of the conductor is equal to
A. 9 volts divided by 2.5 amperes
B. the current multiplied by 9 volts
C. 2.5 amperes divided by the voltage

The correct answer is A. The problem gives you voltage and current and asks for resistance. The formula you should use is I = V/R. Because you're looking for resistance, it might be helpful to rewrite the formula as R = V/I. Resistance equals voltage divided by current.

19. What current passes through a conductor with a resistance of 25 ohms if the potential difference is 15 volts?

What does this problem ask you to find?

A. the potential difference
(B.) the current
C. the mass of the conductor

What information does this problem give you?

(A.) the resistance is 25 ohms
B. the resistance is 15 ohms
C. the potential difference is 85 volts

In this problem, the current is equal to

A. the resistance divided by 15 volts
B. the potential difference multiplied by 25 ohms
(C.) 15 volts divided by 25 ohms

The correct answer is C. The problem gives you resistance and potential difference (voltage) and asks for current. The formula you should use is I=V/R. The current (I) is equal to the voltage divided by the resistance.

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

TUTOR: Listen as your partner reads the problem and decides whether enough information, too much information, or just the right amount of information is given. Explanations are given so you can help your partner.

20. What is the resistance of a conductor if the potential difference is 60 volts?

NOT ENOUGH

You need to know the current in the conductor.

21. What is the potential difference if the current is 4.3 amperes and the resistance of the conductor is 60 ohms?

JUST RIGHT

22. A 60 foot wire with a resistance of 100 ohms is carrying a current of 10 amperes. What is the potential difference?

TOO MUCH

You don't need to know the length of the wire.

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

TUTOR: Listen as your partner reads each problem. Then help him/her answer the questions. The correct answers are circled. Sometimes there will be explanations for you to read to your partner.

23. The resistance of a conductor is 120 ohms. The potential difference is 24 volts. How much current passes through the conductor?

What are you looking for in this problem?

A. speed
B. resistance
(C.) current

Which formula will you need?

A. I = V/R
(B.) I = V x R
C. I = a x V

After filling in all the numbers you can, what does the equation look like?

I = 24 V/120 Ω

24. A current of 8.4 amperes passes through a conductor. If the resistance of the conductor is 80 ohms, what is the potential difference?

What are you looking for in this problem?

(A.) the potential difference
B. speed
C. resistance

Which formula will you need?

(A.) V = I x R
B. V = I/R
C. V = F x I

After filling in all the numbers you can, what does the equation look like?

V = 8.4 A x 80 Ω

25. What is the current through a resistance of 5 ohms when an 8 volt battery is used?

What is the resistance?
A. 8 ohms
(B) 5 ohms
C. 5 volts

What is the battery's voltage?
A. 5 volts
(B) 8 volts
C. 8 ohms

What does this problem ask you to find?
(A) current
B. resistance
C. mass

To solve this problem, you need to know the resistance and
A. the battery's current
(B) the battery's voltage
C. the battery's mass

Which formula will you need to solve this problem?
(A) I = V/R
B. I = V x R
C. I = m x R

To find the current, you will have to _____ 8 volts by 5 ohms.
A. multiply
B. decrease
(C) divide

After filling in all the numbers you can, what does this equation look like?
I = 8 V / 5 Ω

ENGLISH SKILLS FOR PHYSICAL SCIENCE

UNIT 1 - Problem Solving in Physical Science

STUDENT VERSION

Center for Language Education and Research

Center for Applied Linguistics

Arlington County Public Schools

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I. MEASUREMENT

Matching

1. Match each symbol on the left to the prefix that it stands for.

c	milli-
d	centi-
m	kilo-
u	mega-
M	hecto-
k	deci-
h	deka-
da	micro-

2. Match each type of measurement on the left with its base unit.

length	kilogram
mass	Kelvin
time	meter
current	second
temperature	ampere
volume	liter

3. Match each prefix on the left with its multiplier.

mega-	100
kilo-	.001
hecto-	1000
deka-	1,000,000
deci-	.01
centi-	.000001
milli-	.1
micro-	10

4. Match each unit on the left with its symbol.

millimeter	m
centimeter	mg
meter	mL
kilometer	km
milliliter	mm
liter	g
milligram	kg
gram	cm
kilogram	L

5. Match each type of measurement on the left with its unit.

energy	newton (N)
force	volt (V)
frequency	joule (J)
potential difference	hertz (Hz)
resistance	ohm (Ω)

MEASUREMENT

Conversion from one unit to another

To convert from one unit to another in the metric system, you need to know base units and what the prefixes mean. The base units are standard units. Other units are described in terms of base units. Most base units have no prefix. (The exception to this rule is "kilogram." You might expect "gram" to be the base unit for mass because it has no prefix.) The prefixes tell you how a unit compares with a base unit. For example, a milliliter is one thousandth as big as a liter. The milli- part means "one thousandth." So to make a liter, you would need one thousand milliliters.

Here are some examples of conversion in the metric system.

A. 111 meters is how many kilometers?
"Kilo-" means "a thousand"; one kilometer is a thousand times bigger than a meter. Another way to say this is one meter is one thousandth as big as a kilometer. So to get the answer, multiply 111 meters by one thousandth (.001). You get .111 Km.

B. 38 centimeters is how many decimeters?
"Centi-" means "a hundredth" and "deci-" means "a tenth." So a centimeter is a hundredth as big as a meter and a decimeter is a tenth as big as a meter. That means a decimeter is ten times bigger than a centimeter. Or you could say that a centimeter is one tenth the size of a decimeter. So to get the answer, multiply 38 centimeters by one tenth (.1). You get 3.8 decimeters.

C. .092 liters is how many milliliters?
"Milli-" means "one thousandth." That means a milliliter is equal to one thousandth of a liter. So if it takes a thousand milliliters to make a liter, multiply .092 by a thousand to get the answer. The answer is 92 mL.

MEASUREMENT

Restate the following measurements in the given units.

6. 4 centimeters = _____ meters.
7. .18 meters = _____ millimeters.
8. 3010 millimeters = _____ centimeters.
9. 7.5 meters = _____ centimeters.
10. 222 centimeters = _____ millimeters.
11. 46 millimeters = _____ meters.
12. 71.3 centimeters = _____ meters.
13. 4900 millimeters = _____ meters.
14. 5 liters = _____ milliliters.
15. 60.7 milliliters = _____ liters.
16. 840 milliliters = _____ liters.
17. .039 liters = _____ milliliters.
18. 95 grams = _____ kilograms.
19. .058 kilograms = _____ milligrams.
20. 67 milligrams = _____ grams.
21. 8.1 kilograms = _____ grams.
22. 32 grams = _____ milligrams.
23. 7400 milligrams = _____ kilograms.
24. 290 grams = _____ kilograms.
25. 654.321 milligrams = _____ kilograms.

MEASUREMENT

Converting from Celsius to Kelvin.

Converting from Celsius (or Centigrade) to Kelvin is very easy. Temperatures on the Kelvin scale are 273 degrees hotter than temperatures on the Celsius scale. So 27 degrees Celsius is 300 Kelvin.

27. If the temperature of a solution is 65° C. what is its temperature on the Kelvin scale?

A. 208 K
B. 338 K
C. 65 K

28. If the temperature outside is 296 K. what is the temperature on the Celsius scale?

A. 23° C
B. 569° C
C. 55° C

II. $S = d/t$

A. FORMULA PROBLEMS

Read each question and circle the correct answer.

1. What does the d stand for in this formula?
   A. distance
   B. density
   C. deceleration

2. What does the t stand for in this formula?
   A. temperature
   B. time
   C. theory

3. What does the S stand for in this formula?
   A. specific heat
   B. speed
   C. standard

4. What is the base unit of measurement for distance?
   A. kilometer
   B. meter
   C. centimeter

5. What is the base unit of measurement for time?
   A. second
   B. hour
   C. minute

6. What is the base unit of measurement for speed?
   A. kilometer/second (km/sec)
   B. meter/second (m/sec)
   C. meter/second^2 (m/sec^2)

7. In this formula, speed is shown in terms of what two measurements?
   A. density and time
   B. velocity and distance
   C. distance and time

$S = d/t$

8. How would you re-arrange this formula to show time in terms of speed and distance?
   A. $t = d/S$
   B. $t = d \times S$
   C. $t = d \div S$

9. How would you re-arrange this formula to show distance in terms of speed and time?
   A. $d = t \div S$
   B. $d = S/t$
   C. $d = t \times S$

10. Which of the following statements is true? Explain your answer.
   A. If the distance increases, then the speed will also increase.
   B. If the distance increases, then the time will also increase.
   C. If the speed increases but the distance stays the same, then the time will increase.

11. What would make the value of S get bigger? Explain your answer.
   A. t would have to get bigger as d stayed the same.
   B. d would have to get smaller as t stayed the same.
   C. d would have to get bigger as t stayed the same.

12. What will happen to the speed if the time gets bigger and bigger? Explain your answer.
   A. The speed will stay the same.
   B. The speed will decrease.
   C. The speed will increase.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

1. An airplane flew 2000 kilometers in 5 hours. How fast was the airplane flying?

How many kilometers did the airplane fly?
   A. 5 km
   B. 2000 km
   C. 2005 km

How long did it take the airplane to fly 2000 kilometers?
   A. 5 hours
   B. 2000 hours
   C. 400 hours

2. How long will it take a car to go from Washington, DC to Los Angeles if the two cities are 3000 miles apart and the car's average speed is 40 miles per hour?

40 miles per hour is the car's
   A. maximum speed
   B. constant speed
   C. average speed

How far is it from Washington to Los Angeles?
   A. 40 miles
   B. 3000 miles
   C. 1500 miles

How far must the car travel?
   A. 40 miles
   B. 3000 miles
   C. 1500 miles

3. A dog is walking down the street at a speed of 3.5 miles per hour. If the dog walks at this pace for 1.5 hours, how far will it walk?

What are you looking for in this problem?
   A. the time it will take the dog to walk 3.5 miles
   B. the distance the dog will walk in 1.5 hours
   C. the dog's average speed

To solve this problem, you need to know the dog's speed and
   A. how many hours the dog will walk
   B. where the dog started
   C. where the dog is going

4. A subway train travels at a speed of 45 miles per hour. How long will it take the subway train to travel 12 miles?

What does this problem ask you to find?
   A. the rate of acceleration of the subway train
   B. the subway train's destination
   C. the time it takes the subway train to travel 12 miles

To reach the solution, you need to know
   A. distance and acceleration
   B. speed and distance
   C. mass and distance

5. A boat sails from one island to another. The two islands are 11 miles apart and it takes the boat 1.2 hours to get from one to the other.

Which question best completes this word problem?
   A. What is the boat's average speed?
   B. What is the boat's maximum speed?
   C. How long was the boat sailing?

6. A camel walks through the desert at a speed of 5 miles an hour. How long will it take the camel to walk 17 miles?

How fast does the camel walk?
   A. 17 miles per hour
   B. 5 miles per hour
   C. 10 miles per hour

How far will the camel walk?
   A. 17 miles
   B. 5 miles
   C. 10 miles

7. The distance between Little Rock and Omaha is 944 kilometers. How fast would a car have to travel to get from Omaha to Little Rock in 12 hours?

944 kilometers is
   A. the distance from Omaha
   B. the distance from Omaha to Little Rock
   C. the distance from Little Rock to Omaha and back

How long will it take the car to drive from Omaha to Little Rock?
   A. 944 hours
   B. 24 hours
   C. 12 hours

8. A greyhound runs 2.4 kilometers in 2.33 minutes. What is the dog's average speed?

This problem asks you to find how fast the greyhound runs. From the information given in the problem, you already know the greyhound runs _____.

A. all day long
B. 2.4 kilometers
C. 2.33 kilometers

You also know from the problem that the greyhound runs 2.4 kilometers _____.

A. every 5 minutes
B. in 2.33 minutes
C. in 2.33 hours

Fill in the blanks.

9. A horse is running 25 miles an hour. How far will it _____ in 15 minutes?

10. Every 6 hours a weed grows another centimeter. How _____ will it take for the _____ to grow 8 centimeters?

Rearrange these parts to make a complete word problem.

11. A snake slithers at a rate of
will it take the snake to slither
How long
3 miles/hour.
4.5 miles?

12. It takes a person 3.5 hours
to walk along a trail
At what speed is
that is 7.2 miles long.
the person walking?

Read the information given and tell what you think the problem should ask.

13. A train travels at an average speed of 110 miles per hour. The train is going from Washington to Baltimore. The two cities are 55 miles apart.

14. A jogger runs 5 miles every morning. It takes the jogger 57 minutes to complete this workout.

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

15. A balloon floats .411 kilometers in .24 hours. What is the balloon's speed?

What does this problem ask you to find?
- A. the balloon's speed
- B. the acceleration of the balloon
- C. the balloon's mass

Which formula will you need?
- A. S=d/t
- B. S=t/d
- C. W=F x d

16. A car is travelling the 606.4 kilometers from Los Angeles to San Francisco. If the car's average speed is 66 kilometers per hour, how long will the trip take?

What does this problem ask you to find?
- A. the car's maximum speed
- B. the time the trip will take
- C. the car's average speed

Write the formula you will need.

_____

17. A steamboat traveled down a river that was 21.8 kilometers long in 1.4 hours. What was the steamboat's average speed?

To find the steamboat's average speed, you will have to _____ the distance by 1.4 hours.
- A. multiply
- B. increase
- C. divide

18. A raft is floating down a river that flows at a rate of 16 miles an hour. How long will it take the raft to travel 3.2 miles?

What are you looking for in this problem?
- A. the speed of the river
- B. the time it will take the raft to travel 3.2 miles
- C. the distance the raft will travel in 1 hour.

What information does this problem give you?
- A. the speed of the river is 16 miles/hour
- B. the speed of the river is 3.2 miles/hour
- C. the raft will travel 16 miles

In this problem, the time it will take the raft to travel 3.2 miles is equal to
- A. the speed of the river multiplied by 3.2 miles
- B. the distance the raft will travel in one hour multiplied by the speed of the raft
- C. 3.2 miles divided by the speed of the river

19. How long will it take a car to go from Duluth to Minneapolis if the car's average speed is 38 miles an hour and the cities are 175 miles apart?

What are you looking for in this problem?
- A. the car's maximum speed
- B. the time it will take the car to travel 175 miles
- C. the distance the car will travel in one hour

What does this problem tell you?
- A. the distance the car will travel
- B. how long the car will travel
- C. the car's maximum speed

In this problem, the time it will take the car to travel 175 miles is equal to
- A. 175 miles divided by the speed
- B. 38 miles an hour divided by the distance
- C. the speed times 175 miles

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

20. A bird is flying at a speed of 47 kilometers per hour. If it flies for 3.6 hours, how far will it fly?

21. A marathon runner is running from Washington, D.C. to Baltimore. It takes him 5 hours to reach Baltimore. How far is it from Washington, D.C. to Baltimore?

22. A skier weighing 70 kilograms is skiing at a speed of 60 miles an hour. How long will it take the skier to ski 2 miles?

23. A space ship is flying at a speed of 1 million miles a day. The Martians plan to reach their destination in 30 days. How far will the space ship fly in that time?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

24. A snake slithers around for .6 hours. In that time, the snake slithers 6.7 kilometers. How fast is the snake slithering?

What does this problem ask you to find?

A. how far the snake slithered
B. the snake's speed
C. the snake's mass

Which equation will you need?

A. S = d/t
B. S = d x t
C. S = t/d

After filling in all the numbers you can, what does the equation look like?

_____

25. If two people row a boat for 1.3 hours and have an average speed of 7.1 kilometers per hour, how far will they travel?

What does this problem ask you to find?

A. the distance the boat will travel
B. the average speed of the boat
C. the boat's mass

Which formula will you need?

A. d = m x a
B. d = t/S
C. d = S x t

After filling in all the numbers you can, what does the equation look like?

_____

26. A rocket ship moves 7000 kilometers through space in 2 seconds. How fast is the rocket moving?

How far did the rocket fly?
- A. 7000 meters
- B. 7000 kilometers
- C. 2 seconds

How long did it take the rocket to travel 7000 kilometers?
- A. 7 meters
- B. 7 seconds
- C. 2 seconds

What does this problem ask you to find?
- A. The speed of the rocket
- B. How far the rocket flew
- C. How long the rocket flew

To solve this problem, you need to know how far the rocket moved and _____.
- A. the distance the rocket flew
- B. the size of the rocket
- C. how long the rocket moved

Which formula will you need to solve this problem?
- A. $t = s \times d$
- B. $s = d/t$
- C. $W = F \times d$

To find the rocket's speed, you will have to _____ 7000 kilometers by 2 seconds.
- A. decrease
- B. divide
- C. multiply

After filling in all the numbers you can, what does the equation look like?

_____

III. $F = m \times a$

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

1. What does the m stand for in this formula?
   A. meter
   B. mass
   C. magnetism

2. What does the a stand for in this formula?
   A. acceleration
   B. ampere
   C. alpha

3. What does the F stand for in this formula?
   A. force
   B. formula
   C. frequency

4. What is the base unit of measurement for mass?
   A. gram (g)
   B. milliliter (mL)
   C. kilogram (kg)

5. What is the base unit of measurement for acceleration?
   A. meter/second^2 (m/sec^2)
   B. meter/second (m/sec)
   C. meter (m)

6. What is the unit of measurement for force?
   A. meter/second^2 (m/sec^2)
   B. kilogram x meter/sec^2 ($kg \times m/sec^2$)
   C. kilogram x meter/sec (kg x m/sec)

7. What is another name for 1 kg x 1 m/sec^2?
   A. work
   B. newton
   C. rate

$F = m \times a$

8. In this formula, force is shown in terms of what two measurements?
   A. meter and acceleration
   B. acceleration and mass
   C. work and mass

9. How would you re-arrange this formula to show acceleration in terms of mass and force?
   A. $a = F/m$
   B. $a = m/F$
   C. $a = m \times F$

10. How would you re-arrange this formula to show mass in terms of force and acceleration?
   A. $m = a/F$
   B. $m = F \times a$
   C. $m = F/a$

11. Which of the following statements is true? Explain your answer.
   A. If the mass increases, then the acceleration will also increase.
   B. If the mass increases, then the force will get bigger.
   C. If the mass increases, then the force will decrease.

12. What will happen to the acceleration if the mass decreases and the force stays the same? Explain your answer.
   A. The acceleration will stay the same.
   B. The acceleration will decrease.
   C. The acceleration will increase.

13. What would make the value of F get smaller? Explain your answer.
   A. If m and a increased, F would get smaller.
   B. If m decreased and a stayed the same, F would get smaller.
   C. If a increased and m stayed the same, F would get smaller.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

1. A tennis player hits a tennis ball with a force of 80 newtons. The ball weighs 50 grams. How fast will the tennis ball accelerate?

How much does the ball weigh?
   A. 80 grams
   B. 50 grams
   C. 50 kilograms

What force does the tennis player hit the ball with?
   A. 50 newtons
   B. 80 joules
   C. 80 newtons

2. If a book has a mass of 1.2 kilograms and is accelerated at the rate of 2 meters per second each second, how much force acted on it?

What did the force act on?
   A. a book
   B. a meter
   C. a kilogram

At what rate did the book accelerate?
   A. 1.2 meters/sec^2
   B. 2 meters/sec^2
   C. 2 meters

1.2 kilograms is the book's
   A. density
   B. mass
   C. force

3. A force of 360 newtons is applied in accelerating a load of bricks at a rate of 3 meters per second each second. What is the mass of the load of bricks?

What are you looking for in this problem?
   A. the mass of one brick
   B. the mass of the load of bricks
   C. the number of bricks in the load

To solve this problem, you need to know the force used and
   A. the mass of one brick
   B. the distance traveled by the load of bricks
   C. the acceleration of the load of bricks

4. A child weighing 15 kilograms is sitting on a swing. If the child is pushed with a force of 32 newtons, what is the rate of acceleration?

What are you looking for in this problem?
   A. the distance the child will travel
   B. the rate of acceleration
   C. the amount of work done

To reach the solution, you need to know
   A. mass and force
   B. distance and force
   C. distance and speed

5. A force of 80 newtons is applied to an object with a mass of 25 kilograms.

   Which question best completes this word problem?
   A. How far will the object travel?
   B. At what rate will the object accelerate?
   C. How much work is done?

6. A loaf of bread with a mass of 624 grams accelerates at a rate of 1.21 meters per second each second. How much force was applied to the loaf of bread?

What is the rate of acceleration?
   A. 1.1 meters
   B. 1.21 meters
   C. 1.21 meters per second squared

What is the mass of the loaf of bread?
   A. 624 grams
   B. 1.21 grams
   C. 320 grams

7. A construction worker pushes a block with a force of 366 newtons. If the block has a mass of 204 kilograms, at what rate will the block accelerate?

366 newtons is
   A. the weight of the block
   B. the force applied to the block
   C. the block's rate of acceleration

204 kilograms is
   A. the block's mass
   B. the block's volume
   C. the force applied to the block

8. A force of 32 newtons is applied in moving a bed with a mass of 55 kilograms. At what rate does the bed accelerate?

From the information given in this problem you know that a force of _____ is applied in moving a bed.
   A. 32 newtons
   B. 32 joules
   C. 4 meters per second

You also know that the bed had a mass of _____.
   A. 32 newtons
   B. 32 kilograms
   C. 55 kilograms

Fill in the blanks.

9. A force of 105 _____ is applied to a crate. The crate has a mass of 6 kilograms. At what ____ will it accelerate?

10. A chair with a ____ of 6 kilograms is _____ at a rate of 2 meters per second squared. How many newtons of _____ were applied to the chair?

Rearrange these parts to make a complete word problem.

11. will the object accelerate?
with a mass of 11.1 kilograms,
If a force of 111 newtons
at what rate
is applied to an object

12. acted on it?
of 1.6 kilograms accelerates
A ball with a mass
at a rate of 2.3 meters/second^2.
How much force

Read the information given and tell what you think the problem should ask.

13. A stack of newspapers with a mass of 9.6 kilograms is accelerated at a rate of .5 meters per second each second.

14. A shopper applies a force of 9 newtons to a shopping cart. The cart has a mass of 3 kilograms.

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

15. With how much force was a certain box kicked if it accelerated at a rate of 2.3 meters per second squared and had a mass of 1.1 kilograms?

What are you looking for in this problem?

A. the speed of the box
B. the box's mass
C. the force applied to the box

Which formula will you need?

A. F=W/d
B. F=m x a
C. F= m/a

16. If a force of 31 newtons is applied to a cannon ball and the ball's mass is 4 kilograms, at what rate does the ball accelerate?

What are you looking for in this problem?
   A. the distance the ball was thrown?
   B. the ball's average speed
   C. the ball's acceleration

Write the formula you will need.

_____

17. How much force is necessary to accelerate an arrow with a mass of 3 kilograms at a rate of .3 meters per second squared?

To find the force, you will have to _____ 3 kilograms by the acceleration.
   A. increase
   B. multiply
   C. divide

18. A force of 87 newtons is applied to an object. How fast will the object accelerate if it has a mass of 2.2 kilograms?

What does this problem ask you to find?
   A. the object's acceleration
   B. the object's mass
   C. the distance the object will travel

What do you know from reading this problem?
   A. the rate of acceleration of the object
   B. the object's mass
   C. the distance the object will travel

In this problem, the object's rate of acceleration is equal to
   A. 87 newtons divided by the object's mass
   B. 2.2 kilograms multiplied by the force that acted on the object
   C. the object's mass divided by 87 newtons

19. If a book has a mass of 1.2 kilograms and it is accelerated at the rate of 2 meters per second squared, how much force was applied?

What does this problem ask you to find?

A. the speed of the book
B. the distance the book traveled
C. the force applied to the book

What information does this problem give you?

A. the book's rate of acceleration
B. the speed of the book
C. the force applied to the book

In this problem, the force applied to the book is equal to

A. the mass of the book divided by the acceleration
B. the speed of the book multiplied by the book's mass
C. the book's mass times 2 meters per second squared

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

20. A bowling ball hit a bowling pin with a force of 32 newtons. At what rate did the bowling pin accelerate?

21. A hockey stick hits a hockey puck with a force of 212 newtons. The puck accelerates at a rate of 3 meters per second squared. What is the mass of the puck?

22. A place kicker is running at a speed of 3 kilometers per hour. His foot hits the ball with a force f 100 newtons. The football accelerates toward the goal posts at the rate of 5 meters/sec^2. What is the mass of the football?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

23. 202 newtons of force is applied to an object. If the object accelerates at the rate of 3.7 meters per second each second, what is its mass?

What are you looking for in this problem?
- A. the object's mass
- B. the object's speed
- C. the rate of the object's acceleration

Which equation will you need?
- A. m = S x d
- B. m = F x a
- C. m = F/a

After filling in all the numbers you can, what does the equation look like?

_____

24. A marble is shot out of a child's hand with a force of .26 newtons. At what rate will the marble accelerate if its mass is 7 grams?

What are you looking for in this problem?
- A. the distance the marble will travel
- B. the marble's acceleration
- C. the force applied to the marble

Which formula will you need?
- A. a = F x d
- B. a = m/F
- C. a = F/m

After filling in all the numbers you can, what does the equation look like?

_____

25. A child swings a bat and hits a ball that has a mass of 1.2 kilograms. The ball accelerated at a rate of 13 meters per second squared. How much force was exerted on the ball?

What was the ball's mass?
- A. 1.2 Kg
- B. 1.2 m
- C. 13 m

13 meters per second squared is the ball's
- A. distance
- B. speed
- C. acceleration

What does this problem ask you to find?
- A. How much the ball weighed
- B. The ball's rate of acceleration
- C. The ball's mass

To solve this problem you need to know how fast the ball accelerated and _____.
- A. the mass of the bat
- B. the mass of the ball
- C. the speed of the bat

Which formula will you need to solve this problem?
- A. $m = D \times v$
- B. $F = W / d$
- C. $F = m \times a$

To find the amount of force that acted on te ball, you will have to _____ 1.2 Kg by 13 m/sec^2.
- A. multiply
- B. divide
- C. increase

After filling in all the numbers you can, what does the equation look like?

_____

IV. $W = F \times d$

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

1. What does the d stand for in this formula?
   A. density
   B. deceleration
   C. distance

2. What does the F stand for in this formula?
   A. force
   B. formula
   C. frequency

3. What does the W stand for in this formula?
   A. wavelength
   B. weight
   C. work

4. What is the unit of measurement for force?
   A. newton
   B. joule
   C. meter/second^2

5. What is the base unit of measurement for distance?
   A. kilometer
   B. meter
   C. centimeter

6. What is the unit of measurement for work?
   A. kilogram x meter
   B. newton
   C. newton x meter

7. What is another name for newton x meter?
   A. acceleration
   B. force
   C. joule

$W = F \times d$

8. In this formula, work is shown in terms of what two measurements?
   A. force and distance
   B. speed and distance
   C. force and density

9. How would you re-arrange this formula to show force in terms of work and distance?
   A. $F = W \times d$
   B. $F = W/d$
   C. $F = d/W$

10. How would you re-arrange the formula to show distance in terms of force and work?
    A. $d = W \times F$
    B. $d = W/F$
    C. $d = F/W$

11. Which of the following statements is true? Explain your answer.
    A. If the force increases, then the distance will also increase.
    B. If the force increases and the distance stays the same, then the work will increase.
    C. If the distance increases, then the force will also increase.

12. What happens to force if work increases but the distance stays the same? Explain your answer.
    A. Force will stay the same.
    B. Force will decrease.
    C. Force will increase.

13. What will happen to the value of d if the force gets larger and larger? Explain your answer.
    A. The value of d will stay the same.
    B. The value of d will decrease.
    C. The value of d will increase.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

1. A firefighter applies a force of 40 newtons in moving a hose 4 meters. How much work is done?

What moved 4 meters?
   A. a force
   B. a firefighter
   C. a hose

How much force was exerted?
   A. 40 newtons
   B. 4 newtons
   C. 4 meters

2. If 200 joules of work is done and 120 newtons of force is applied to a large rock, how far will the rock move?

How much force was applied?
   A. 120 joules
   B. 200 newtons
   C. 120 newtons

How much work was done in moving the rock?
   A. 200 joules
   B. 120 joules
   C. 120 newtons

3. 650 joules of work was done in moving a sofa 20 meters. How much force was applied to the sofa?

What is this problem asking you to find?
   A. the force applied to the sofa
   B. the mass of the sofa
   C. the rate of acceleration of the sofa

To solve this problem, you need to know how far the sofa was moved and
   A. the mass of the sofa
   B. the speed of the sofa
   C. the amount of work done

4. How much work was done if a force of 175 newtons was applied in moving a piano 9 meters?

What does this problem ask you to find?
   A. the rate of acceleration
   B. the mass of the piano
   C. the amount of work done

To reach the solution, you need to know
   A. mass and acceleration
   B. force and mass
   C. force and distance

5. A file cabinet moves 2.2 meters when 375 joules of work are done.

   Which question best completes this word problem?
   A. What is the mass of the file cabinet?
   B. How much force was applied to the file cabinet?
   C. What is the average speed of the file cabinet?

6. How much work is done if 60 newtons of force is applied to a crate of oranges, moving the crate .04 meters?

How far has the crate moved?
A. 4 meters
B. .04 meters
C. 60 meters

How much force is applied?
A. 60 newtons
B. 60 meters
C. .04 newtons

7. The perimeter of a room is 32 meters. How much work will be done in pushing a vacuum cleaner around the room if a force of 51 newtons is applied to the vacuum cleaner?

What is the distance the vacuum cleaner will move?
A. 51 meters
B. 32 meters
C. 32 newtons

51 newtons is
A. the weight of the vacuum cleaner
B. the amount of work done
C. the force applied to the vacuum cleaner

8. If 88 newtons of force is applied to a desk and 132 joules of work is done, how far will the desk move?

From the information given in this problem, you know that _____ of work was done.
A. 132 newtons
B. 132 joules
C. 88 joules

This problem also tells you that _____ was applied to the desk.
A. 88 newtons of force
B. 132 joules of work
C. 132 newtons of force

Fill in the blanks.

9. A _____ of 58 newtons is applied in lifting a lamp .7 meters. How much _____ is done?

10. If 2200 _____ of work is done in pulling a cart 32 meters, how much _____ was applied?

Rearrange these parts to make a complete word problem.

11. that weighs 35 newtons
Suppose you lift a box
work was done?
How much
a distance of 21 millimeters.

12. how far will
If 325 joules of work
is applied to a hat rack,
the hat rack be moved?
is done, and 77 newtons of force

Read the information given and tell what you think the problem should ask.

13. 320 joules of work is done and a force of 62 newtons is applied to a desk.

14. A force of 24 newtons is applied to a garbage bag full of leaves. The bag moves 13 meters.

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

15. 83 joules of work is done in lifting a bicycle. If the bicycle is lifted .8 meters, how many newtons does the bike weigh?

What does this problem ask you to find?

A. the mass of the bike
B. the force applied to the bike
C. the weight of the bike in newtons

Which formula will you need?

A. $F = W \times d$
B. $F = W/d$
C. $F = m \times a$

16. How much work is done if a force of 72 newtons is applied to a chair, pushing the chair 3.7 meters?

What does this problem ask you to find?
A. the force applied in lifting the chair
B. the force applied in pushing the chair
C. the amount of work done

Write the formula you will need.

_____

17. An object moves .83 meters when 27 newtons of force is applied. How much work was done?

To find the amount of work done, you must multiply 27 newtons by _____.
A. the mass of the object
B. the distance the object moves
C. the volume of the object

18. How much work is done in lifting a pumpkin 1.2 meters if the pumpkin weighs 49 newtons?

What are you looking for in this problem?
A. the mass of the pumpkin
B. the amount of work done in lifting the pumpkin
C. the speed of the pumpkin

What does this problem tell you?
A. The pumpkin is rolled 1.2 meters.
B. The pumpkin is lifted 1.2 meters.
C. The pumpkin's mass is 1.2 kilograms.

In this problem, the amount of work done is equal to
A. 49 newtons divided by 1.2 meters
B. the pumpkin's mass divided by 49 newtons
C. 1.2 meters multiplied by 49 newtons

19. If 200 joules of work is done and 120 newtons of force is applied to a large rock, how far will it move?

What are you looking for in this problem
   A. the speed of the rock
   B. the rock's rate of acceleration
   C. the distance the rock will move

What do you know from reading this problem?
   A. the mass of the rock
   B. the amount of work that was done
   C. the distance the rock will move

In this problem, the distance the rock will move is equal to
   A. the work done multiplied by 120 newtons
   B. 200 joules divided by the force applied to the rock
   C. the acceleration divided by 200 joules

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

20. How much work is done in swimming 50 meters in a swimming pool?

21. 925 joules of work is done in carrying a bale of hay. The bale weighs 185 newtons and has a volume of .336 cubic meters. How far was the bale carried?

22. A student uses 1 newton of force in moving a pencil 1 meter. How much work does the student do?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

23. A crane is lifting construction materials. How high does it lift a load if 1879 joules of work is done and the load weighs 817 newtons?

What does this problem ask you to find?

A. the mass of the load
B. the distance the load was lifted
C. the force applied to the building materials

Which formula will you need?

A. $d = W/F$
B. $d = W \times F$
C. $d = W \times m$

After filling in all the numbers you can, what does the equation look like?

_____

24. In pushing a crate 9 meters, 411 joules of work was done. What force was applied to the crate?

What does this problem ask you to find?

A. the rate of acceleration
B. the force applied to the crate
C. the crate's mass

Which formula will you need?

A. F = W/d
B. F = d/W
C. F = W/a

After filling in all the numbers you can, what does the equation look like?

_____

25. A worker applies a force of 52 newtons to a big crate and the crate moves 2.1 meters. How much work was done?

How far did the crate move?
- A. 52 meters
- B. 2.1 meters
- C. 2.1 newtons

How much force was exerted?
- A. 52 newtons
- B. 52 meters
- C. 2.1 newtons

What does this problem ask you to find?
- A. the weight of the crate
- B. the amount of work that was done
- C. the distance the crate moved

To solve this problem, you need to know how far the crate moved and _____.
- A. the weight of the crate
- B. the mass of the crate
- C. the force that the worker applied to the crate

Which formula will you need to solve this problem?
- A. F = W x d
- B. W = F x d
- C. W = m x a

To find the amount of work that was done, you will have to _____ 2.1 meters by 52 newtons.
- A. divide
- B. decrease
- C. multiply

After filling in all the numbers you can, what does this equation look like?

_____

V. $D = m/v$

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

1. What does the m stand for in this formula?
   A. meter
   B. molecule
   C. mass

2. What does the v stand for in this formula?
   A. velocity
   B. volume
   C. voltage

3. What does the D stand for in this formula?
   A. density
   B. deceleration
   C. distance

4. What is the base unit of measurement for volume?
   A. liter
   B. milliliter
   C. gram

5. What is the base unit of measurement for mass?
   A. gram
   B. kilogram
   C. milliliter

6. What is the base unit of measurement for density?
   A. gram/meter (g/m)
   B. kilogram/liter (kg/L)
   C. newton/liter (N/L)

7. In this formula, density is shown in terms of what two measurements?
   A. matter and volume
   B. mass and volume
   C. mass and velocity

$D = m/v$

8. How would you re-arrange this formula to show mass in terms of volume and density?
   A. $m = D/v$
   B. $m = D \times v$
   C. $m = v/D$

9. How would you re-arrange this formula to show volume in terms of density and mass?
   A. $v = D \times m$
   B. $v = D/m$
   C. $v = m/D$

10. Which of the following statements is true? Explain your answer.
   A. If the volume decreases, then the density will increase.
   B. If the volume decreases, then the mass will also decrease.
   C. If the volume increases, then the density will also increase.

11. What would happen to the density if the mass decreased and the volume stayed the same? Explain your answer.
   A. The density would stay the same.
   B. The density would decrease.
   C. The density would increase.

12. What would make the value of m get larger? Explain your answer.
   A. If volume and density decreased, the value of m would increase.
   B. If volume stayed the same and density increased, the value of m would increase.
   C. If density decreased and the volume stayed the same, the value of m would increase.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

1. 20 milliliters of a solution has a mass of 45 grams. What is the density of the solution?

What is the volume of the solution?
   A. 45 milliliters
   B. 20 milliliters
   C. 20 grams

What is the mass of the solution?
   A. 45 grams
   B. 20 grams
   C. 20 milligrams

2. A bowl of soup has a mass of 300 grams. The density of the soup is 2.2 grams per milliliter. How much soup is in the bowl?

What is the mass of the soup in the bowl?
   A. 300 grams
   B. 2.2 grams
   C. 300 milliliters

Besides mass, what else does this problem tell you about the soup?
   A. its temperature
   B. its density
   C. its volume

What is the density of the soup?
   A. 300 grams
   B. 2.2 grams per milliliter
   C. 2.2 grams per liter

3. 800 milliliters of orange juice has a density of 1.3 grams/milliliter. What is the mass of the orange juice?

What is this problem asking you to find?
   A. the density of the juice
   B. the mass of the juice
   C. the temperature of the juice

To solve this problem, you need to know the density of the juice and
   A. the kind of container the juice is in
   B. the volume of the juice
   C. the temperature of the juice

4. A bunch of raisins having a mass of 50 grams and a volume of 24 cubic centimeters has what density?

What are you looking for in this problem?
   A. the weight of the raisins
   B. the density of the raisins
   C. how many raisins there are

To reach the solution, you need to know
   A. volume and mass
   B. mass and temperature
   C. weight and mass

5. A solution has a density of 3.1 grams per milliliter. The mass of the solution is 8 grams.

   Which question completes this word problem?
   A. What is the weight of the solution?
   B. What is the temperature of the solution?
   C. What is the volume of the solution?

6. If a bottle of vinegar has a volume of 750 milliliters and a mass of 730 grams, what is its density?

The mass of the vinegar is
   A. 730 grams
   B. 750 grams
   C. 750 milliliters

The volume of the vinegar is
   A. 730 grams
   B. 750 grams
   C. 750 milliliters

7. The density of ketchup is 2.3 grams per milliliter. What is the volume of 39 grams of ketchup?

39 grams is
   A. the ketchup's mass
   B. the ketchup's weight
   C. the ketchup's volume

2.3 grams per milliliter is
   A. the density of the ketchup
   B. the mass of the ketchup
   C. the volume of the ketchup

8. 40 milliliters of a solution is in a test tube. The density of this solution is 1.39 grams per milliliter. What is the mass of the solution in the test tube?

This problem gives you values for _____.
   A. density and mass
   B. mass and volume
   C. volume and density

According to this problem, the volume of the solution in the test tube is _____.
   A. 1.39 grams per milliliter
   B. 1.39 milliliters
   C. 40 milliliters

Fill in the blanks.

9. The paint in a can has a mass of 450 grams. The density is 2.7 _____. What is the volume?

10. 8.3 milliliters of a solution has a mass of 10.6 grams. What is the _____ of the _____?

Rearrange these parts to make a complete word problem.

11. The volume of this solution is
of 4.5 grams/milliliter.
7.8 milliliters.
What is the mass of the solution?
There is a solution with a density

12. of the substance
a substance if 26.2 grams
What is the density of
has a volume of
5.1 milliliters?

Read the information given and tell what you think the problem should ask.

13. A carrot has a density of 2.3 grams per milliliter. The volume of the carrot is 42 milliliters.

14. The juice in a 2 liter bottle has a mass of 2.3 kilograms.

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

15. The density of a mud puddle is 3.82 grams per milliliter. What is the mass of the mud puddle if its volume is 2.6 liters?

What are you looking for in this problem?

A. the mass of the mud puddle
B. the volume of the mud puddle
C. the temperature of the mud puddle

Which formula will you need?

A. $m = D/v$
B. $m = D \times v$
C. $M = a \times D$

16. A solution in a test tube has a volume of 12 milliliters. If the mass of the solution is 13.3 grams, what is its density?

What are you looking for in this problem?
A. the weight of the solution
B. the density of the solution
C. the temperature of the solution

Write the formula you will need.

_____

17. What is the density of a glass of juice if 100 milliliters has a mass of 132 grams?

To find the density of the juice, you will have to divide 132 grams by _____.
A. the temperature of the juice
B. the mass of the juice
C. the volume of the juice

18. The jelly in a jar has a density of 2.1 grams per milliliter. What is the mass of 96 milliliters of jelly?

What does this problem ask you to find?
A. the mass of 96 milliliters of jelly
B. the volume of a jar of jelly
C. the mass of a jar of jelly

What does this problem tell you?
A. the volume of the jar
B. the mass of one milliliter of jelly
C. the mass of 96 milliliters of jelly

In this problem, the mass of 96 milliliters of jelly is equal to
A. 96 milliliters divided by the density of the jelly
B. the mass of the whole jar divided by 96
C. the jelly's density multiplied by 96 milliliters

19. A bowl of soup has a mass of 350 grams. The soup's density is 4.1 grams per milliliter. What is the volume of soup in the bowl?

What does this problem ask you to find?
- A. the volume of the bowl of soup
- B. the mass of the soup
- C. the temperature of the soup

What does this problem tell you?
- A. the volume of the soup
- B. the mass of the soup
- C. the temperature of the soup

In this problem, the volume of the soup is equal to
- A. 4.1 grams per milliliter divided by the mass of the soup
- B. 350 grams multiplied by the soup's density
- C. the soup's mass divided by 4.1 grams per milliliter

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

20. A can of peaches has a mass of 425 grams. What is the volume of half a can if the density of peaches is 3.8 grams per milliliter?

21. A pig has a mass of 33 kilograms. The pig's volume is 30 liters. What is the pig's density?

22. Sea water has a density of 1.33 grams per milliliter. It's boiling point is 90° C. What is the mass of sea water?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

23. A bowl of ice cream has a density of 2.8 grams per milliliter. What is the volume of the ice cream if its mass is 82 grams?

What are you looking for in this problem?

A. the ice cream's density
B. the mass of the ice cream
C. the ice cream's volume

Which formula will you need?

A. v = m/D
B. v = m x D
C. v = D/m

After filling in all the numbers you can, what does the equation look like?

_____

24. If a board has a mass of 1.7 kilograms and a volume of 620 milliliters, what is the board's density?

What are you looking for in this problem?

A. the board's length
B. the board's density
C. the board's mass

Which formula will you need?

A. D = t x S
B. D = v/m
C. D = m/v

After filling in all the numbers you can, what does the equation look like?

_____

25. 36 milliliters of a solution has a mass of 39 grams. What is the solution's density?

What is the volume of the solution?
A. 36 milliliters
B. 39 grams
C. 39 milliliters

What is the solution's mass?
A. 36 milliliters
B. 36 grams
C. 39 grams

What does this problem ask you to find?
A. the mass of the solution
B. the weight of the solution
C. the density of the solution

To solve this problem, you need to know the mass of the solution and _____.
A. the volume of the solution
B. the weight of the solution
C. the temperature of the solution

Which formula will you need to solve this problem?
A. D = m x a
B. D = m / v
C. D = m x v

To find the solution's density, you will have to _____ 39 grams by 36 milliliters.
A. decrease
B. divide
C. multiply

After filling in all the numbers you can, what does this equation look like?

_____

VI. speed = wavelength x frequency

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

1. What is the unit of measurement for wavelength?
   A. second
   B. meter
   C. kilometer

2. What is the unit of measurement for frequency?
   A. second
   B. second^2
   C. 1 cycle/second

3. What is another name for 1 cycle/second?
   A. hertz
   B. sound
   C. vibration

4. How would you re-arrange this formula to show wavelength in terms of speed and frequency?
   A. wavelength = frequency/speed
   B. wavelength = speed x frequency
   C. wavelength = speed/frequency

5. How would you re-arrange this formula to show frequency in terms of wavelength and speed?
   A. frequency = speed/wavelength
   B. frequency = wavelength/speed
   C. frequency = speed x wavelength

6. Which of the following statements is true? Explain your answer.
   A. If wavelength and frequency decrease, speed will increase.
   B. If wavelength decreases and frequency stays the same, then speed will increase.
   C. If wavelength increases and frequency stays the same, then speed will increase.

speed = wavelength x frequency

7. What would happen to speed if wavelength decreased and frequency stayed the same? Explain your answer.
   A. Speed would stay the same.
   B. Speed would decrease.
   C. Speed would increase.

8. What would make the frequency get larger? Explain your answer.
   A. If the speed increased and the wavelength stayed the same, the frequency would get larger.
   B. If the speed decreased and the wavelength stayed the same, the frequency would get larger.
   C. If the wavelength increased and the speed stayed the same, the frequency would get larger.

9. What would happen to the wavelength if the frequency got larger and the speed stayed the same? Explain your answer.
   A. Wavelength would stay the same.
   B. Wavelength would decrease.
   C. Wavelength would increase.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

1. A television station broadcasts a long tone as part of its Emergency Broadcast System. If the tone has a frequency of 300 hertz and a wavelength of .5 meters, how fast is the wave going?

Where does the tone come from?
   A. the telephone
   B. a television station is broadcasting it
   C. the radio

What is the frequency of the wave?
   A. 300 Hz
   B. .5 Hz
   C. .5 meters

Besides frequency, what else does this problem tell you about the sound?
   A. volume
   B. speed
   C. wavelength

2. What is the frequency of a sound that moves 410 meters a second and has a wavelength of 6.5 meters?

What is the speed of these soundwaves?
   A. 63 meters a second
   B. 6.5 meters a second
   C. 410 meters a second

6.5 meters is
   A. the wavelength
   B. the frequency
   C. the speed

3. A violin produces a tone with a frequency of 440 hertz. If the speed of the sound waves is 320 meters per second, what is the wavelength?

What are you looking for in this problem?
   A. the source of the sound
   B. the amplitude
   C. the wavelength

To solve this problem, you need to know the speed and
   A. the amplitude
   B. the frequency
   C. the source of the sound

4. What is the frequency of a sound that has a wavelength of .9 meters and moves at a speed of 287 meters per second?

What does this problem ask you to find?
   A. amplitude
   B. frequency
   C. speed

To reach the solution, you need to know
   A. wavelength and amplitude
   B. amplitude and speed
   C. speed and wavelength

5. A sound has a frequency of 395 hertz. Its wavelength is .75 meters.

   Which question best completes this word problem?
   A. How fast are the soundwaves moving?
   B. How loud is the sound?
   C. What is the amplitude of the soundwaves?

6. What is the frequency of a horn if the speed of the soundwaves is 373 meters per second and the wavelength is 1.8 meters?

373 meters per second is the sound's
   A. wavelength
   B. speed
   C. frequency

1.8 meters is the sound's
   A. amplitude
   B. wavelength
   C. speed

7. A sound has a frequency of 524 hertz and a speed of 389 meters per second. What is the wavelength?

What is the frequency of the sound?
   A. 389 meters
   B. 524 hertz
   C. 524 meters

How fast is the sound moving?
   A. 524 meters
   B. 389 meters
   C. 389 meters per second

8. How fast is a sound going if it has a frequency of 354 hertz and a wavelength of 3.54 meters?

In this problem, you are told that the _____ is 3.54 meters.
   A. wavelength
   B. speed
   C. frequency

You also know that 354 _____ is the frequency.
   A. meters per second
   B. hertz
   C. meters

Fill in the blanks.

9. If the frequency of a certain sound is 440 _____ and the wavelength is 1.7 meters, then what is its _____?

10. What is the frequency of a _____ if its _____ is .97 meters and its speed is 385 _____?

Rearrange these parts to make a complete word problem.

11. If a sound has a frequency of
speed of the wave?
491 hertz and a wavelength of
what is the
1.75 meters,

12. 333.3 meters/second and it has
its speed is
What is the frequency of the sound?
Suppose there is a sound and
a wavelength of 3.3 meters.

Read the information given and tell what you think the problem should ask.

13. A car's horn has a frequency of 640 hertz. When the horn is sounded, the waves move at a speed of 381 meters per second.

14. A sound has a speed of 388 meters per second and a wavelength of 2.5 meters.

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

15. A flute plays a sound with a frequency of 330 hertz. The wavelength is .8 meters. What is the speed of the sound waves?

What does this problem ask you to find?

A. the volume of the sound
B. the speed of the sound waves
C. the frequency of the sound

Which formula will you need?

A. speed = d/t
B. speed = frequency/wavelength
C. speed = wavelength x frequency

16. When a drum is banged, the wavelength of the sound waves is 1.68 meters. What is the frequency of the sound if the speed of the soundwaves is 388 meters per second?

What does this problem ask you to find?
A. frequency
B. amplitude
C. speed

Write the formula you will need.

_____

17. If a sound has a frequency of 603 hertz and a speed of 412 meters per second, what is the wavelength?

To find the wavelength, you will have to _____ the speed by 603 hertz.
A. divide
B. decrease
C. multiply

18. A singer sings a note with a frequency of 494 hertz. The speed is 385 meters per second. What is the wavelength?

What does this problem ask you to find?
A. the speed of the sound
B. the wavelength of the sound wave
C. the amplitude of the sound

What do you know about this problem?
A. the frequency is 385 hertz
B. the speed is 385 meters per second
C. the wavelength is .08 meters

In this problem, the wavelength is equal to
A. the speed of the soundwaves divided by 494 hertz
B. the frequency divided by 385 meters per second
C. the speed of the soundwaves divided by 385 hertz

19. What is the frequency of a sound that moves 339 meters in a second and has a wavelength of 1.36 meters?

What are you looking for in this problem?
- A. the frequency
- B. the amplitude
- C. the wavelength

After reading this problem, what do you know?
- A. the speed is 339 miles an hour
- B. the speed is 1.36 meters a second
- C. the speed is 339 meters a second

In this problem, the frequency is equal to
- A. 1.36 meters times 339 meters per second
- B. the amplitude divided by 1.36 meters
- C. 339 meters per second divided by the wavelength

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

20. What is the frequency of a train whistle if the wavelength is .88 meter?

21. The frequency of the school bell that rings every 50 minutes is 524 hertz. The wavelength is 1.5 meters and the amplitude is .8 meters. What is the speed?

22. An x-ray travels at a speed of 200 m/sec. It has a wavelength of .5 m. What is the frequency?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

23. The frequency of a whistle is 612 hertz. If the speed of the sound waves is 399 meters per second, what is the wavelength?

What does this problem ask you to find?
- A. the speed of the soundwaves
- B. the wavelength of the soundwaves
- C. the frequency of the soundwaves

Which formula will you need?
- A. wavelength = speed x frequency
- B. wavelength = speed/frequency
- C. wavelength = frequency x amplitude

After filling in all the numbers you can, what does the equation look like?

_____

24. How fast does the sound of a car's squeaking brakes travel if the frequency of the sound is 708 hz and the wavelength is 1.3 meters?

What does this problem ask you to find?
- A. the volume of the sound
- B. the speed of the soundwaves
- C. the speed of the car

Which formula will you need?
- A. speed = distance/time
- B. speed = wavelength/frequency
- C. speed = frequency x wavelength

After filling in all the numbers you can, what does the equation look like?

_____

25. A musical instrument makes a sound that has a frequency of 440 hertz and a wavelength of .86 meters. How fast is the wave going?

What is the frequency of the sound?
A. .86 meters
B. .86 hertz
C. 440 hertz

What is the wavelength?
A. 440 hertz
B. .86 hertz
C. .86 meters

What does this problem ask you to find?
A. the volume of the sound
B. the speed of the wave
C. the frequency of the sound

To solve this problem, you need to know the wavelength and the _____.
A. amplitude
B. volume
C. frequency

Which formula will you need to solve this problem?
A. speed = wavelength x frequency
B. speed = wavelength / frequency
C. speed = wavelength x amplitude

To find the wave's speed, you will have to _____ .86 meters by 440 hertz.
A. increase
B. divide
C. multiply

After filling in all the numbers you can, what does this equation look like?

_____

VII. $I = V/R$

A. FORMULA QUESTIONS

Read each question and circle the correct answer.

1. What does the R stand for in this formula?
   A. radiation
   B. resistance
   C. rate

2. What does the V stand for in this formula?
   A. voltage
   B. volume
   C. velocity

3. What does the I stand for in this formula?
   A. inertia
   B. Celsius
   C. current

4. What is the unit of measurement for voltage?
   A. watt
   B. volt
   C. ohm

5. What is the unit of measurement for resistance?
   A. watt
   B. volt
   C. ohm

6. What is the unit of measurement for current?
   A. ohm (Ω)
   B. volts/ohm (V/Ω)
   C. volts/meter (V/m)

7. What is another name for volts/ohm?
   A. watt
   B. ampere
   C. electricity

8. What two measurements define current in this formula?
   A. resistance and voltage
   B. voltage and rate
   C. volume and resistance

$I = V/R$

9. How would you re-arrange this formula to show resistance in terms of current and voltage?
   A. $R = V/I$
   B. $R = I/V$
   C. $R = V \times I$

10. How would you re-arrange this formula to show voltage in terms of current and resistance?
   A. $V = I/R$
   B. $V = I \times R$
   C. $V = R/I$

11. Which of the following statements is true? Explain your answer.
   A. If the voltage increases, then the current will decrease.
   B. If the voltage increases, then the current will also increase.
   C. If the voltage increases, then the resistance will decrease.

12. What would make the value of I get larger? Explain your answer.
   A. If the resistance got smaller and the voltage stayed the same, then the value of I would get larger.
   B. If the voltage got smaller and the resistance stayed the same, then the value of I would get larger.
   C. If the resistance got larger and the voltage stayed the same, then the value of I would get larger.

13. What happens to V when I increases and R stays the same? Explain your answer.
   A. V stays the same.
   B. V decreases.
   C. V increases.

B. WORD PROBLEMS

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

1. What is the current through a resistance of 10 ohms when a 24 volt battery is used?

What is the resistance of the conductor?
   A. 10 ohms
   B. 24 volts
   C. 2.4 amperes

What does this problem say about the battery?
   A. The problem mentions the battery's mass.
   B. The problem mentions the battery's voltage.
   C. The problem mentions the battery's resistance.

2. If a current running through a conductor is .86 amperes and a 12 volt battery is used, what is the resistance of the conductor?

What is the voltage of the battery?
   A. 12 volts
   B. .86 volts
   C. 12.86 volts

What is the current?
   A. 12 amperes
   B. .86 volts
   C. .86 amperes

3. What is the voltage of the battery if a current of 1.5 amperes passes through a conductor with a resistance of 11 ohms?

What is this problem asking you to find?
   A. the battery's voltage
   B. the battery's mass
   C. the battery's resistance

To solve this problem, you need to know resistance and
   A. current
   B. speed
   C. the mass of the battery

4. If a current of 1.3 amperes passes through a conductor and a 9 volt battery is used, what is the resistance of the conductor?

What are you looking for in this problem?
A. resistance
B. voltage
C. speed

To reach the solution, you need to know
A. voltage and speed
B. current and voltage
C. current and mass

5. A conductor has a resistance of 50 ohms. A 9 volt battery is used.

Which question best completes this word problem?
A. What is the mass of the battery?
B. What current passes through the conductor?
C. What is the speed of the current?

6. What is the potential difference if a conductor's resistance is 95 ohms and a current of 4.7 amperes passes through that conductor?

The resistance of the conductor is
   A. 95 ohms
   B. 4.7 ohms
   C. 47 ohms

4.7 amperes is the
   A. speed
   B. resistance
   C. current

7. If a current of 7.77 amperes passes through a conductor and the potential difference is 24 volts, what is the conductor's resistance?

What is the current?
   A. 24 volts
   B. 24 amperes
   C. 7.77 amperes

What is the potential difference?
   A. 24 volts
   B. 24 amperes
   C. 7.77 volts

8. What current passes through a conductor with a resistance of 10 ohms and a potential difference of 12.3 volts?

What do you know from reading this problem?
   A. potential difference and resistance
   B. resistance and current
   C. current and potential difference

This problem tells you that the resistance is _____.
   A. 12.3 ohms
   B. 12.3 volts
   C. 10 ohms

Fill in the blanks.

9. What is the current running through a conductor if a 12 _____ battery is used and the _____ is 12 ohms?

10. A _____ of .35 amperes passes through a conductor with a resistance of 80 _____. What is the _____ of the battery used?

Rearrange these parts to make a complete word problem.

11. what is the resistance of the conductor?
through a conductor.
If a 12 volt battery is used,
There is a current
of .8 amperes running

12. if there is a current
of 1.2 amperes?
What is the voltage of the battery
a resistance of 120 ohms.
A conductor has

Read the information given and tell what you think the problem should ask.

13. A conductor has a resistance of 25 ohms. A current of 1.6 amperes passes through this conductor.

14. A current of .49 amperes passes through a conductor. A 24 volt battery is being used.

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

15. What is the current passing through a conductor if the resistance of the conductor is 77 ohms and the potential difference is 8.5 volts?

What are you looking for in this problem?

A. voltage
B. current
C. mass

Which formula will you need?

A. $I = V/R$
B. $I = V \times R$
C. $I = m \times P$

16. What is the resistance of a conductor if the potential difference is 11 volts and 5.3 amperes of current passes through the conductor?

What are you looking for in this problem?
- A. the potential difference
- B. the conductor's mass
- C. the conductor's resistance

Write the formula you will need.

_____

17. A current of 7.9 amperes passes through a conductor with a resistance of 30 ohms. What is the potential difference?

To find the potential difference, you will have to _____ 30 ohms by 7.9 amperes.
- A. multiply
- B. increase
- C. divide

18. What is the resistance of a conductor when a 9 volt battery is used and a current of 2.5 amperes passes through the conductor?

What are you looking for in this problem?
- A. the mass of the battery
- B. the resistance of the battery
- C. the resistance of the conductor

What do you know from reading this problem?
- A. the battery's current
- B. the battery's voltage
- C. the speed of the current

In this problem, the resistance of the conductor is equal to
- A. 9 volts divided by 2.5 amperes
- B. the current multiplied by 9 volts
- C. 2.5 amperes divided by the voltage

19. What current passes through a conductor with a resistance of 25 ohms if the potential difference is 15 volts?

What does this problem ask you to find?
- A. the potential difference
- B. the current
- C. the mass of the conductor

What information does this problem give you?
- A. the resistance is 25 ohms
- B. the resistance is 15 ohms
- C. the potential difference is 85 volts

In this problem, the current is equal to
- A. the resistance divided by 15 volts
- B. the potential difference multiplied by 25 ohms
- C. 15 volts divided by 25 ohms

Does the problem give you enough information for you to find the solution? If not, tell what the problem should have told you. Does the problem give you too much information? If so, tell any unnecessary information the problem gives.

20. What is the resistance of a conductor if the potential difference is 60 volts?

21. What is the potential difference if the current is 4.3 amperes and the resistance of the conductor is 60 ohms?

22. A 60 foot wire with a resistance of 100 ohms is carrying a current of 10 amperes. What is the potential difference?

Read each problem carefully. Make sure you understand every word. Answer the questions that follow the problem.

23. The resistance of a conductor is 120 ohms. The potential difference is 24 volts. How much current passes through the conductor?

What are you looking for in this problem?
A. speed
B. resistance
C. current

Which formula will you need?
A. I = V/R
B. I = V x R
C. I = a x V

After filling in all the numbers you can, what does the equation look like?

_____

24. A current of 8.4 amperes passes through a conductor. If the resistance of the conductor is 80 ohms, what is the potential difference?

What are you looking for in this problem?
A. the potential difference
B. speed
C. resistance

Which formula will you need?
A. V = I x R
B. V = I/R
C. V = F x I

After filling in all the numbers you can, what does the equation look like?

_____

25. What is the current through a resistance of 5 ohms when an 8 volt battery is used?

What is the resistance?
A. 8 ohms
B. 5 ohms
C. 5 volts

What is the battery's voltage?
A. 5 volts
B. 8 volts
C. 8 ohms

What does this problem ask you to find?
A. current
B. resistance
C. mass

To solve this problem, you need to know the resistance and
A. the battery's current
B. the battery's voltage
C. the battery's mass

Which formula will you need to solve this problem?
A. $I = V/R$
B. $I = V \times R$
C. $I = m \times R$

To find the current, you will have to _____ 8 volts by 5 ohms.
A. multiply
B. decrease
C. divide

After filling in all the numbers you can, what does this equation look like?

_____